

# MOODY AIR FORCE BASE GEORGIA



## MOODY INSTALLATION GUIDE SPECIFICATIONS

June 2024

VOLUME 1  
DIVISIONS 01-13

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21 13 25	02/19, CHG 1: 02/21	HIGH-EXPANSION FOAM SYSTEM, FIRE PROTECTION
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22 05 83.63	08/22	CURED-IN-PLACE PIPE (CIPP) LINING FOR PLUMBING APPLICATIONS
22 07 19.00 40	08/16	PLUMBING PIPING INSULATION
22 13 29	02/11	SANITARY SEWERAGE PUMPS
22 13 36	02/09	PNEUMATIC SEWAGE EJECTORS
22 14 29.00 40	05/17	SUMP PUMPS
22 15 09.00 40	05/22	GENERAL SERVICE COMPRESSED-AIR SYSTEMS CLEANING PROCEDURES
22 15 13.16 40	11/17	HIGH-PRESSURE COMPRESSED-AIR PIPING, PIPING COMPONENTS, AND VALVES, STAINLESS
22 15 14.00 40	11/17	GENERAL SERVICE COMPRESSED-AIR SYSTEMS, LOW PRESSURE
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22 15 19.19 20	05/11	NONLUBRICATED ROTARY SCREW AIR COMPRESSORS (100 HP AND LARGER)
22 15 26.00 20	04/06	HIGH AND MEDIUM PRESSURE COMPRESSED AIR PIPING
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23 31 13.00 40	08/22	METAL DUCTS

23 33 56	02/09	SELF-ACTING BLAST VALVES
23 34 23.00 40	02/17	HVAC POWER VENTILATORS
23 35 16.17 10	05/20	MECHANICAL ENGINE [ AND WELDING FUME] EXHAUST SYSTEMS
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32 13 14.13	08/19	CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS
32 13 43	05/20	PERVIOUS CONCRETE PAVING
32 16 19	05/18	CONCRETE CURBS, GUTTERS AND SIDEWALKS
32 17 23	08/16, CHG 5: 11/18	PAVEMENT MARKINGS
32 18 16.13	08/17	PLAYGROUND PROTECTIVE SURFACING
32 31 13	11/21	CHAIN LINK FENCES AND GATES
32 31 13.53	11/21	HIGH-SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES
32 32 23.13	02/20	SEGMENTAL CONCRETE BLOCK RETAINING WALL
32 84 23	02/21	UNDERGROUND SPRINKLERS
32 84 24	08/11, CHG 1: 05/17	IRRIGATION SPRINKLER SYSTEMS
32 92 19	08/17, CHG 1: 08/21	SEEDING
32 92 23	04/06, CHG 1: 08/21	SODDING
32 93 00	08/17, CHG 1: 08/21	EXTERIOR PLANTS

**DIVISION 33 - UTILITIES**

33 01 30.16	11/21	TV INSPECTION OF SEWER LINES
33 01 30.72	11/21	RELINING SEWERS
33 01 50.31	02/20	LEAK DETECTION FOR FUELING SYSTEMS
33 01 50.55	02/21	CLEANING OF PETROLEUM STORAGE TANKS
33 05 23	08/15, CHG 2: 08/16	TRENCHLESS UTILITY INSTALLATION
33 05 23.13	11/19	UTILITY HORIZONTAL DIRECTIONAL DRILLING
33 11 00	02/18, CHG 1: 02/22	WATER UTILITY DISTRIBUTION PIPING
33 11 23	11/09, CHG 1: 08/17	NATURAL GAS AND LIQUID PETROLEUM PIPING
33 16 15	11/20	WATER STORAGE STEEL TANKS
33 26 00.00 10	04/08	RELIEF WELLS

33 30 00	05/18		SANITARY SEWERAGE
33 31 23.00 10	08/18		SANITARY SEWER FORCE MAIN PIPING
33 32 16	11/19		PACKAGED UTILITY WASTEWATER PUMPING STATIONS
33 34 56.00 10	08/18		DRAINAGE FIELD DOSING CHAMBERS
33 40 00	11/21		STORMWATER UTILITIES
33 46 13	05/20		FOUNDATION DRAINAGE
33 46 16	05/18		SUBDRAINAGE PIPING
33 47 13	11/14,	CHG 2: 11/15	POND AND RESERVOIR LINERS
33 51 13.00 30	05/10		NATURAL-GAS METERING
33 51 15	08/19		NATURAL-GAS / LIQUEFIED PETROLEUM GAS DISTRIBUTION PIPELINES
33 51 39	08/17		MONITORING WELLS
33 51 43	05/22		INSTRUMENTATION AND PERFORMANCE MONITORING OF STRUCTURES
33 52 10	11/18,	CHG 1: 11/20	FUEL SYSTEMS PIPING (SERVICE STATION)
33 56 53	05/20		COMPRESSED GASES STORAGE TANKS
33 57 55	11/18,	CHG 1: 11/20	FUEL SYSTEM COMPONENTS (NON-HYDRANT)
33 60 02	04/08		ABOVEGROUND HEAT DISTRIBUTION SYSTEM
33 61 13	08/10,	CHG 1: 02/20	PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM
33 61 13.13	02/16		PREFABRICATED UNDERGROUND HYDRONIC ENERGY DISTRIBUTION
33 61 13.19	02/16		VALVES, PIPING, AND EQUIPMENT IN VALVE MANHOLES
33 61 14	02/10		EXTERIOR BURIED PREINSULATED WATER PIPING
33 63 13	04/06		EXTERIOR UNDERGROUND STEAM DISTRIBUTION SYSTEM
33 63 13.19	02/16		CONCRETE TRENCH HYDRONIC AND STEAM ENERGY DISTRIBUTION
33 63 14	04/06		EXTERIOR BURIED PUMPED CONDENSATE RETURN
33 63 16	07/06		EXTERIOR SHALLOW TRENCH STEAM DISTRIBUTION
33 63 23	04/06		EXTERIOR ABOVEGROUND STEAM DISTRIBUTION
33 71 01	05/19,	CHG 1: 11/19	OVERHEAD TRANSMISSION AND DISTRIBUTION
33 71 01.00 40	11/14,	CHG 1: 02/17	OVERHEAD TRANSMISSION AND DISTRIBUTION
33 71 02	08/21		UNDERGROUND ELECTRICAL DISTRIBUTION
33 73 00.00 40	05/19		UTILITY TRANSFORMERS
33 75 00.00 40	11/14		SWITCHGEAR AND PROTECTION DEVICES
33 77 19.00 40	08/16		MEDIUM-VOLTAGE SWITCH
33 77 36.00 40	05/17		MEDIUM-VOLTAGE UTILITY FUSES
33 82 00	04/06		TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

**DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT**

41 22 13.14	11/19,	CHG 1: 02/21	BRIDGE CRANES, OVERHEAD ELECTRIC, TOP RUNNING
41 22 13.15	02/20,	CHG 1: 02/21	BRIDGE CRANES, OVERHEAD ELECTRIC, UNDER RUNNING
41 22 13.16	04/08,	CHG 1: 02/20	GANTRY CRANES
41 22 13.55	02/22	CHG 1: 05/22	BRIDGE CRANES, UNDER RUNNING, AIRCRAFT HANGAR

-- End of Project Table of Contents --

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## SECTION 01 11 00

SUMMARY OF WORK  
08/15, CHG 2: 08/21

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Salvage Plan; G1.2 WORK COVERED BY CONTRACT DOCUMENTS

## 1.2.1 Project Description

The Contractor shall furnish all management, supervision, labor, materials, equipment, and incidentals required for a broad range of maintenance, repair, and minor construction work on various real property facilities at installations covered under this contract, including design and engineering services incidental to construction. The Contracting Officer (CO) will conduct negotiations with the Contractor and issue individual task orders for maintenance, repair, and minor construction projects identified by the Base Civil Engineer (BCE). Individual task order projects will vary in size, as identified in the contract, including but not limited to trades such as carpentry, plumbing, electrical, mechanical, painting, pipe fitting, sheet metal, welding, roofing, site work, site utilities, excavation, concrete Masonry, pavement repair, asbestos and lead paint removal, security hardware installation, and demolition.

## 1.2.2 Location

The work performed under this contract is located at the Moody AFB, GA, and Avon Park AFR, FL.

## 1.3 OCCUPANCY OF PREMISES

If building(s) are to be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area by the Contractor no less than 10 working days prior to starting work.

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

## 1.4 EXISTING WORK

In addition to FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements:

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered



during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

#### 1.5 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. The Civil Engineer Work Clearance Request Program is processed electronically. The Contractor shall initiate an AF Form 103, Base Civil Engineer Work Clearance Request, for each Task Order. The Contractor shall call the Georgia Utility Protection Center at 1-800-282-7411, specify that surveys need to be **marked in paint only**, obtain a Dig Permit Number in order to start the AF Form 103 process, and then clearly outline the intended construction area with white utility marking paint. The Contractor will submit the dig permit information to the 23d Civil Engineer Squadron SABER Project Manager (PM) to initiate the AF e103 for the appropriate Work Clearance Working Group members to visit the site to perform utility locate/marketing services. Once the AF e103 has been approved, the SABER PM will provide one copy to the Contractor prior to commencement of any work for the project. The Contractor must have an approved copy of the AF e103 for each Task Order at each Task Order jobsite. Verify existing utility locations indicated on contract drawings, within area of work.

##### 1.5.1 Notification Prior to Excavation

Notify the Contracting Officer at least 48 hours prior to starting excavation work.

#### 1.6 SALVAGE MATERIAL AND EQUIPMENT

Items designated by the Contracting Officer to be salvaged remain the property of the Government. Segregate, itemize, deliver and off-load the salvaged property at the Government designated storage area **to be** located within **5 miles** of the construction site.

Provide a **salvage plan**, listing material and equipment to be salvaged, and their storage location. Maintain property control records for material or equipment designated as salvage. Provide a system for property control in the salvage plan. Store and protect salvaged materials and equipment until disposition by the Contracting Officer.

#### PART 2 PRODUCTS

Not used.

#### PART 3 EXECUTION

Not used.

-- End of Section --

## SECTION 01 14 00

WORK RESTRICTIONS  
11/11, CHG 14: 02/22

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel

## 1.2 CONTRACTOR ACCESS AND USE OF PREMISES

## 1.2.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment, include delivery vehicles, are clearly identified with their company name.

## 1.2.1.1 Subcontractors and Personnel Contacts

Provide a [list of contact personnel](#) of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

## 1.2.1.2 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas [if requested](#).

## 1.2.2 Working Hours

Regular working hours will consist of an [9 hour period](#), between 7 a.m. and [4:00 p.m.](#), Monday through Friday, excluding Government holidays.

## 1.2.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application [no less than 72 hours](#) prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification

provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed or coordinated otherwise.

#### 1.2.4 Occupied Building(s)

If the Contract dictates that the Contractor shall be working in an existing building or around existing buildings which are occupied the Contractor shall not enter the building(s) without prior approval of the Contracting Officer.

The existing buildings and their contents must be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains, and Government material located in the limits of construction during the construction period.

Relocate movable furniture away from the Contractor's working area as required to perform the work, protect the furniture, and replace the furniture in its original location upon completion of the work. Leave attached equipment in place, and protect against damage, or temporarily disconnect, relocate, protect, and reinstall at the completion of the work.

#### 1.2.5 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and natural gas are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.
- d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

Not Used

-- End of Section --

## SECTION 01 30 00

## ADMINISTRATIVE REQUIREMENTS

11/20, CHG 2: 05/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

(2014) Safety -- Safety and Health  
Requirements Manual

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

[View Location Map](#)

[Progress and Completion Pictures](#)

SD-04 Samples

[Color Boards; G](#)

## 1.3 COLOR BOARDS FOR AIR FORCE PROJECTS

Submit one set of color boards with material finishes submittals. Include samples of colors and finishes of interior surfaces, such as walls, floors, and ceilings. Present the samples on 8 by 10-1/2 inches boards (modules) with a maximum spread of 24 by 31-1/2 inches for foldouts. Design modules to fit in a standard loose-leaf, three-ring binder. Where special finishes such as architectural concrete, carpet, or prefinished textured metal panels are required, submit samples not less than 12 inches square with the board. If more space is needed, more than one board per set may be submitted. Certify that the color samples have been reviewed in detail, and that the color samples are in strict accordance with contract drawings and specifications, except as may be otherwise explicitly stated. Submittal of color samples does not relieve the Contractor of the responsibility to submit samples required elsewhere herein.

## 1.4 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 10 digital photographs each week throughout the entire project

from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Contracting Officer. Submit photos with the monthly invoice to the Contracting Officer, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Also provide the view location sketch on the CD or DVD as a digital file. Include a date designator in file names. Photographs provided are for unrestricted use by the Government.

#### 1.5 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 Liability, during the entire period of performance under this contract. Provide other insurance coverage as required by Georgia state law.

#### 1.6 SUPERVISION

##### 1.6.1 Superintendent Qualifications

Provide project superintendent with a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

##### 1.6.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

##### 1.6.3 Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend Red Zone meetings, partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

##### 1.6.4 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

## 1.7 PRECONSTRUCTION CONFERENCE

Immediately after award Upon completion of design and design acceptance by the government Prior to any work commencing on the site, the Contracting Officer will coordinate a time and place to meet for the Preconstruction Conference. The purpose of this conference is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, base-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, cybersecurity, prosecution of the work, government acceptance, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

### 1.7.1 Attendees

Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), Quality Control Manager and major subcontractors.

## 1.8 FACILITY TURNOVER PLANNING MEETINGS (Red Zone Meetings)

Meet with the Government to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start planning the turnover process at the Pre-Construction Conference meeting with a discussion of the Red Zone process and convene at regularly scheduled NRZ Meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

### 1.8.1 Red Zone Checklist

- a. Contracting Officer will provide the Contractor a copy of the Red Zone Checklist template.
- b. Prior to 75 percent completion, modify the Red Zone Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Red Zone Checklist to the Contracting Officer. The Contracting Officer may request additional activities be added to the Red Zone Checklist at any time as necessary.

### 1.8.2 Meetings

- a. Conduct Red Zone Meetings beginning at approximately 75 percent project completion.
- b. The Contracting Officer will establish the frequency of the meetings dependant on the size and complexity of the construction.
- c. Using the Red Zone Checklist as a Plan of Action and Milestones (POAM) and basis for discussion, review upcoming critical activities and strategies to ensure work is completed on time.
- d. During the Red Zone Meetings discuss with the Contracting Officer any upcoming activities that require Government involvement.
- e. Maintain the Red Zone Checklist by documenting the actual completion

dates as work is completed and update the Red Zone Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current Red Zone Checklist to attendees at each Red Zone Meeting.

#### 1.9 PARTNERING

To most effectively accomplish **Task Orders**, the Contractor and Government must form a cohesive partnership with the common goal of drawing on the strength of each organization in an effort to achieve a successful project without safety mishaps, conforming to the Contract, within budget and on schedule. The partnering team must consist of personnel from both the Government and Contractor including project level and corporate level leadership positions. Key Personnel from the supported command, end user, **CES**, Contractor, key subcontractors and the Designer of Record are **highly encouraged** to participate in the Partnering process.

##### 1.9.1 Team-Led (Informal) Partnering

- a. The Contracting Officer will coordinate the initial Team-Led (Informal) Partnering Session with key personnel of the project team, including Contractor and Government personnel. The Partnering Session will be co-led by the **CES Project** Manager and Contractor's Project Manager.
- b. The Initial Team-led Partnering session **will** be held concurrently with the **Preconstruction Conference** meeting. Partnering sessions will be held at a location mutually agreed to by the Contracting Officer and the Contractor, typically at a conference room on-base or at the Contractor's temporary trailer.
- c. The Initial Team-Led Partnering Session will be conducted and facilitated using electronic media (a video and accompanying forms) provided by Contracting Officer.
- d. The Partners will determine the frequency of the follow-on sessions.
- e. Participants will bear their own costs for meals, lodging and transportation associated with Partnering.

##### 1.10 MOBILIZATION

Contractor shall **coordinate** mobilization to the jobsite **with the Government** within **45** calendar days after contract award **for bid-build or 30** calendar days of final site or building design approval **if design-build**. Mobilize is defined as having equipment AND having a physical presence of at least one person from the contractor's team on the jobsite.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

-- End of Section --

## SECTION 01 32 01.00 10

PROJECT SCHEDULE  
02/15

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AACE INTERNATIONAL (AACE)

AACE 29R-03 (2011) Forensic Schedule Analysis  
AACE 52R-06 (2006) Time Impact Analysis - As Applied  
in Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G

Preliminary Project Schedule; G

Initial Project Schedule; G

Periodic Schedule Update; G

## 1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of 2-years experience scheduling construction projects similar in size and nature to this project with scheduling software that meets the requirements of this specification. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

## PART 2 PRODUCTS

## 2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

## 2.1.1 Government Default Software

The Government intends to use Primavera P6.



### 2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file must be created and supported by the software manufacturer.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of design and construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Designers, Subcontractors and suppliers working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

### 3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN.

#### 3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

#### 3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

### 3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

#### 3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will

consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

### 3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities may have Original Durations (OD) greater than 20 work days.

### 3.3.3 Design and Permit Activities

Include design and permit activities with the necessary conferences and follow-up actions and design package submission dates. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. Provide at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Also include review and correction periods associated with each item.

### 3.3.4 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

### 3.3.5 Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).
- b. Submission, review and acceptance of features require design completion  
Submission, review and acceptance of design packages.
- c. Submission of mechanical/electrical/information systems layout drawings.
- d. Long procurement activities
- e. Submission and approval of O & M manuals.
- f. Submission and approval of as-built drawings.
- g. Submission and approval of DD1354 data and installed equipment lists.
- h. Submission and approval of testing and air balance (TAB).
- i. Submission of TAB specialist design review report.
- j. Submission and approval of fire protection specialist.
- k. Submission and approval of Building Commissioning Plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent

with the contract commissioning requirements. All tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.

- l. Air and water balancing.
- m. Building commissioning - Functional Performance Testing.
- n. Controls testing plan submission.
- o. Controls testing.
- p. Performance Verification testing.
- q. Other systems testing, if required.
- r. Contractor's pre-final inspection.
- s. Correction of punch list from Contractor's pre-final inspection.
- t. Government's pre-final inspection.
- u. Correction of punch list from Government's pre-final inspection.
- v. Final inspection.

#### 3.3.6 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: [approvals](#), [acceptance](#), [design reviews](#), environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

#### 3.3.7 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or effect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case by case basis.

##### 3.3.7.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

##### 3.3.7.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "End Project."

Constrain the project schedule to the Contract Completion Date in such a

way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

### 3.3.7.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

#### 3.3.7.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

#### 3.3.7.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

### 3.3.8 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop sSeasonal Calendar(s) and assign to seasonally affected activities as applicable.

If an activity is weather sensitive it should be assigned to a calendar showing non-work days on a monthly basis, with the non-work days selected at random across the weeks of the calendar, using the anticipated adverse weather delay work days provided in the Special Contract Clauses. Assign non-work days over a seven-day week as weather records are compiled on seven-day weeks, which may cause some of the weather related non-work days to fall on weekends.

### 3.3.9 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Acknowledged" may have no predecessor logic, and the last activity -"End Project" may have no successor logic.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

### 3.3.10 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF

dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

#### 3.3.11 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

#### 3.3.12 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

#### 3.3.13 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

#### 3.3.14 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Government and not used in place of realistic original durations, must not be in place to artificially absorb float, or to replace proper schedule logic.

- a. Leads (negative lags) are prohibited.
- b. Start to Finish (SF) relationships are prohibited.

#### 3.3.15 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

#### 3.3.16 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management.

#### 3.3.17 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete.

### 3.3.18 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

#### 3.3.18.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than \$35,000 or 1 percent of the present contract value, which ever is greater, up to \$200,000. Activity will be declared 100 percent complete upon the Government's approval.

#### 3.3.18.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than \$20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

### 3.3.19 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

- a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and manhours) and the Government agreeing that the schedule is reasonable and achievable.
- b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

## 3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD/DVD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

### 3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged submit the [Preliminary Project Schedule](#) defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining

performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities.

### 3.4.2 Initial Project Schedule Submission

Submit the **Initial Project Schedule** for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. **Include in the design-build schedule detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead item acquisition prior to design completion.** Also cover in the initial design-build schedule the entire construction effort with as much detail as is known at the time but, as a minimum, include all construction start and completion milestones, and detailed construction activities through the dry-in milestone, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the then approved schedule update all remaining detailed construction activities that are planned to occur after the dry-in milestone. No payment will be made for work items not fully detailed in the Project Schedule.

#### 3.4.2.1 Design Package Schedule Submission

With each design package submitted to the Government, submit a fragment schedule extracted from the then current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

### 3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress. Update the schedule to include detailed construction activities as the design progresses, but not later than the submission of the final un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission if such activity is authorized.

- a. Update information including Actual Start Dates (AS), Actual Finish

Dates (AF), Remaining **Period of Performance (PoP)**, and Percent Complete is subject to the approval of the Government at the meeting.

- b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.

### 3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

#### 3.5.1 Data CD/DVDs

Provide two sets of data CD/DVDs containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include on the data CD/DVDs the Narrative Report and all required Schedule Reports. Label each CD/DVD indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file name. Each schedule must have a unique file name and use project specific settings.

#### 3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for any problems, either current or potential, which are revealed through that analysis. Include the following information as minimum in the Narrative Report:

- a. Identify and discuss the work scheduled to start in the next update period.
- b. A description of activities along the two most critical paths where the total float is less than or equal to 20 work days.
- c. A description of current and anticipated problem areas or delaying factors and their impact and an explanation of corrective actions taken or required to be taken.
- d. Identify and explain why activities based on their calculated late dates should have either started or finished during the update period but did not.
- e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. Include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.
- f. Identify and discuss out-of-sequence work.

#### 3.5.3 Schedule Reports

The format, filtering, organizing and sorting for each schedule report will be as directed by the Contracting Officer. Typically, reports contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. The



following lists typical reports that will be requested:

#### 3.5.3.1 Activity Report

List of all activities sorted according to activity number.

#### 3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

#### 3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

#### 3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date, which reflects the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. Provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

#### 3.5.3.5 Schedule Log

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

#### 3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

##### 3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

##### 3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

##### 3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

#### 3.5.4.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

### 3.6 PERIODIC SCHEDULE UPDATE

#### 3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. Provide a draft of the proposed narrative report and schedule data file to the Government a minimum of two workdays in advance of the meeting. The Contractor's Project Manager and scheduler must attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the periodic schedule update meeting, make corrections to the draft submission. Include only those changes approved by the Government in the submission and invoice for payment.

#### 3.6.2 Update Submission Following Progress Meeting

Submit the complete [Periodic Schedule Update](#) of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 work days after the periodic schedule update meeting.

### 3.7 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs and Submittals.

### 3.8 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer in accordance with the contract provisions and clauses for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Government request for proposal (RFP) to justify time extensions.

#### 3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

#### 3.8.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for approval by the Contracting Officer based on industry standard [ACE 52R-06](#). Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

#### 3.8.3 Forensic Schedule Analysis (Retrospective Analysis)

Prepare an analysis for approval by the Contracting Officer based on industry standard [ACE 29R-03](#).

#### 3.8.4 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis consisting of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the project schedule.

#### 3.8.5 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

#### 3.8.6 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The Contractor must show that an early completion was achievable had it not been for the impact.

### 3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a **Corrective Action Plan (CAP)** for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

#### 3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the **CAP** must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

#### 3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental **CAP** may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

#### 3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

### 3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, may not be considered for the exclusive use of either the Government or the Contractor including activity and/or project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the contract completion date milestone.

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## SECTION 01 32 16.00 20

## SMALL PROJECT CONSTRUCTION PROGRESS SCHEDULES

08/18, CHG 1: 08/20

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Baseline Construction Schedule; G

Baseline Design Schedule; G

## SD-07 Certificates

Monthly Updates

## 1.2 PRE-CONSTRUCTION SCHEDULE REQUIREMENT

Within 30 calendar days after contract award and Prior to the start of work, prepare and submit to the Contracting Officer a [Baseline Design Schedule and Baseline Construction Schedule](#) in the form of a [Network Analysis Schedule \(NAS\) Bar Chart Schedule](#) in accordance with the terms in Contract Clause FAR 52.236-15 Schedules for Construction Contracts, except as modified in this contract. The approval of a Baseline Construction Schedule is a condition precedent to:

- a. The Contractor starting demolition work or construction stage(s) of the contract.
- b. Processing Contractor's invoice(s) for construction activities/items of work.
- c. Review of any schedule updates.

Submittal of the Baseline [Design and Construction Schedule](#), and subsequent schedule updates, is understood to be the Contractor's certification that the submitted schedule meets the requirements of the Contract Documents, represents the Contractor's plan on how the work will be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced (as-built logic).

## 1.3 SCHEDULE FORMAT

1.3.1 [Network Analysis Schedule \(NAS\)](#)

Use the critical path method (CPM) to schedule and control project activities. Prepare and maintain project schedules using Primavera P6 or Microsoft Project. Importing data into the scheduling program using data conversion techniques or third party software is cause for rejection of the submitted schedule.

Within 15 calendar days after approval of the Initial Schedule or approval of the final design for a design build project, submit to the Contracting Officer a final NAS schedule.

#### 1.3.1.1 Activity Requirements

- a. At a minimum, identify the following in the schedule:
  - (1) Design and Construction time for major systems and components
  - (2) Each activity assigned with its appropriate Responsibility Code
  - (3) Each activity assigned with its appropriate Phase and Area Codes
  - (4) Major submittals and submittal processing time
  - (5) Major equipment lead time
- b. Build the Schedule as follows:
  - (1) Show design periods, submittals, Government review periods, material/equipment delivery, utility outages, on-site construction, inspection, testing, and closeout activities. Government and Contractor on-site work activities must be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days for 5-day work week calendars.
  - (2) With the exception of the Contract Award and End Contract milestone activities, use of open-ended activities is not allowed; each activity must have predecessor and successor ties. No activity must have open start or open finish (dangling) logic. Minimize redundant logic ties. Once an activity exists on the schedule it must not be deleted or renamed to change the scope of the activity and must not be removed from the schedule logic without approval from the Contracting Officer. While an activity cannot be deleted, where said activity is no longer applicable to the schedule but must remain within the logic stream for historical record, it can be changed to a milestone. Document any such change in the milestone's "Notebook," including a date and explanation for the change. The ID number for a deleted activity must not be re-used for another activity.
  - (3) Assign each activity its appropriate Responsibility Code and Area Code, indicating location and responsibility to accomplish the work indicated by the activity, Phase Code, and Work Location Code. Include anticipated tasks to be assigned Government responsibility.
  - (4) Date/time constraints or lags, other than those required by the contract, are not allowed unless approved by the Contracting Officer. Include as the last activity in the contract schedule, a milestone activity named "Contract Completion Date".
  - (5) Include the following Contract Milestones:
    - (a) Include as the first activity on the schedule a start milestone titled "Contract Award", which must have a Mandatory Start constraint equal to the Contract Award Date;

(b) Include Interim or Phased Completion Milestones required by the Contract or as approved by the Contracting Officer;

(c) Include Facility Turnover Planning Meeting Milestones;

(d) Include an unconstrained finish milestone on the schedule titled "Substantial Completion". Substantial Completion is defined as the point in time the Government would consider the project ready for beneficial occupancy wherein by mutual agreement of the Government and Contractor. Government use of the facility is allowed while construction access continues in order to complete remaining items (e.g. punch list and other close out submittals).

(e) Include an unconstrained finish milestone on the schedule titled "Projected Completion". Projected Completion is defined as the point in time the Government would consider the project complete. This milestone must have the Contract Completion Date (CCD) milestone as its only successor.

(f) Include as the last activity on the schedule a finish milestone titled "Contract Completion (CCD)" with constraint type "Must Finish No Later Than". Calculation of schedule updates must be such that if the finish of the "Projected Completion" milestone falls after the contract completion date, then negative float will be calculated on the longest path and if the finish of the "Projected Completion" milestone falls before the contract completion date, the float calculation must reflect positive float on the longest path. This milestone must be set to 5:00 pm.

(6) Provide lead time for major equipment.

#### 1.3.1.2 Anticipated Weather Lost Work Days

Use the National Oceanic and Atmospheric Administration's (NOAA) Summary of Monthly Normals report to obtain the historical average number of days each month with precipitation, using a nominal 30-year, greater than 0.10 inch precipitation amount parameter, as indicated on the Station Report for the NOAA location closest to the project site as the basis for establishing a "Weather Calendar" showing the number of anticipated non-workdays for each month due to adverse weather, in addition to Saturdays, Sundays and all Federal Holidays as non-work days.

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities are on the longest path to contract completion in the period when delay occurred. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity. Impacts resulting from adverse weather must be documented in Narrative Report for the month that it occurred.

Make changes to P6 or MS project calendars to reflect as-built conditions where work occurred where originally anticipated as non-work days, and



where work did not occur (lost work day).

#### 1.3.1.3 Activity Identification

- a. Identify Government, Quality Control Management (QCM), Construction activities planned for the project and other activities that could impact project completion if delayed.
- b. Identify administrative type activity/milestones including pre-construction submittal and permit requirements prior to demolition or construction stage.
- c. Create separate activities for each Phase, Area, Floor Level, and Location the activity is occurring.
- d. Do not use construction category activity to represent non-work type reference (Such as, Serial Letter or Request for Information) in NAS.
- e. Place non-work reference within P6 activity details notebook. Activity categories included in the schedule are specified below.

#### 1.3.1.4 Responsibility Code

Assign each activity its appropriate Responsibility Code indicating responsibility to accomplish the work indicated by the activity, Phase Code and Work Location Code.

#### 1.3.1.5 Primavera P6 Settings and Parameters

Use the following Primavera P6 settings and parameters in preparing the Baseline Schedule. Deviation from these settings and parameters, without prior consent of the Contracting Officer, is cause for rejection of schedule submission.

- a. General: Define or establish Calendars and Activity Codes at the "Project" level, not the "Global" level.
- b. Admin Drop-Down Menu, Admin Preferences, Time Periods Tab:
  - (1) Set time periods for P6 to 8.0 Hours/Day, 40.0 Hours/Week, 172.0 Hours/Month and 2000.0 Hours/Year.
  - (2) Use assigned calendar to specify the number of work hours for each time period: Must be checked.
- c. Admin Drop-Down Menu, Admin Preferences, Earned Value Tab: Earned Value Calculation: Use "Budgeted values with current dates".
- d. Project Level, Dates Tab: Set "Must Finish By" date to "Contract Completion Date", and set "Must Finish By" time to 05:00pm.
- e. Project Level, Defaults Tab:
  - (1) Duration Type: Set to "Fixed Duration & Units".
  - (2) Percent Complete Type: Set to "Physical".
  - (3) Activity Type: Set to "Task Dependent".

(4) Calendar: Set to "Standard 5 Day Workweek". Calendar must reflect Saturday, Sunday and all Federal holidays as non-work days. Alternative calendars may be used with Contracting Officer approval.

f. Project Level, Calculations Tab:

- (1) Activity percent complete based on activity steps: Must be Checked.
- (2) Reset Remaining Duration and Units to Original: Must be Checked.
- (3) Subtract Actual from At Completion: Must be Checked.
- (4) Recalculate Actual units and Cost when duration percent complete changes: Must be Checked.
- (5) Link Actual to Date and Actual This Period Units and Cost: Must be Checked.
- (6) Price/Unit: Set to "\$1/h".
- (7) Update units when costs change on resource assignments: Must be Unchecked.

g. Project Level, Settings Tab:

- (1) Define Critical Activities: Check "Longest Path".

h. The NAS must have a minimum of 30 construction activities. No on-site construction activity may have durations in excess of 20 working days.

#### 1.3.1.6 Microsoft Project Settings and Parameters

Use the following MS Project 2010 settings and parameters in preparing the Baseline Schedule:

- a. The Network must have a minimum of 30 construction activities.
- b. No on-site construction activity may have durations in excess of 20 working days.
- c. Critical is defined as having zero days of Total Slack. Within the Baseline Schedule no more than 20 percent of the activities shall be critical.
- d. Logic: include the following setting: File, Options, Schedule tab - Split in-progress tasks - must be selected.
- e. Status Date gridline is displayed in the Gantt Chart view.
- f. Task Type is set to Fixed Work for "boots-on-the-ground" construction activities.
- g. Task Type is set to Fixed Duration for design activities, submittals, Government reviews, procurement, material/equipment delivery, and utility outages.
- h. "Effort Driven" is turned ON for Fixed Duration tasks.

- i. Time Periods established for the project are set to 8 Hrs/Day, 40 Hrs/Week and 20 days/month.
- j. Week starts on Monday must be selected.
- k. Default start time is set to 8am (0800).
- l. Default end time is set to 5pm (1700).

#### 1.3.1.7 Cost Loading Microsoft Project 2010 Schedules

Assign material, labor and equipment costs to their respective Construction Activities. Assign material and equipment costs, for which payment will be requested in advance of installation, to their respective procurement activity (i.e. the material/equipment on-site activity). Evenly disperse overhead and profit to each activity over the duration of the project. Cost loading must total to 100 percent of the value of the contract.

##### 1.3.1.7.1 Software Settings

###### a. Resource Sheet

- (1) Resource Name: Enter each code and resource for the project
- (2) Type: Set to "Material"
- (3) Material Label: Enter units of measurement for each resource
- (4) Std. Rate: Enter unit cost for each resource
- (5) Accrue at: Set to "Prorated"

###### b. Assigning Resources to Each Activity

- (1) Select each activity in Gantt Chart
- (2) Assign resources, Resource Tab
- (3) Select each resource and enter the quantity of the units; then, assign the resource(s) to the activity

###### c. Baseline for Earned Value Calculation, File Tab, Options, Advanced, Default task Earned Value method: Set to "Physical Percent Complete" or as directed by the Contracting Officer

##### 1.3.1.7.2 Tabular Reports

###### 1.3.1.7.2.1 Tracking Gantt Schedule with Cost Table

Submit a Tracking Gantt Schedule with each schedule update showing activity baseline cost, cost percent complete, and Budgeted Cost of Work Performed (BCWP), as directed by the Contracting Officer.

###### 1.3.1.7.2.2 Earned Value Over Time Report

- a. With each schedule submission, submit Earned Value Over Time Report S-Curves indicating Planned Value to the contract completion date based on projected early and late activity finish dates and Earned Value.
- b. Revise Earned Value Over Time Report S-Curves when the contract is modified, or as directed by the Contracting Officer.

##### 1.3.2 Bar Chart Schedule

The Bar Chart must, as a minimum, show work activities, submittals,

Government review periods, material/equipment delivery, utility outages, on-site construction, inspection, testing, and closeout activities. The Bar Chart must be time scaled and generated using an electronic spreadsheet program.

### 1.3.3 Schedule Submittals and Procedures

Submit Schedules and updates in hard copy and on electronic media that is acceptable to the Contracting Officer. **Submit an electronic back-up of the project schedule in an import format compatible with the Government's scheduling program.**

### 1.4 SCHEDULE MONTHLY UPDATES

Update the Design and Construction Schedule at monthly intervals, **or as needed**, or when the schedule has been revised. Keep the updated schedule current, reflecting actual activity progress and plan for completing the remaining work. Submit copies of purchase orders and confirmation of delivery dates as directed by the Contracting Officer.

a. Narrative Report: Identify and justify the following:

- (1) Progress made in each area of the project;
- (2) Longest Path: Include printed copy on **11 by 17 inch** paper, landscape setting;
- (3) Date/time constraint(s), other than those required by the contract;
- (4) Listing of changes made between the previous schedule and current updated schedule including: added or removed activities, original and remaining durations for activities that have not started, logic (sequence, constraint, lag/lead), milestones, planned sequence of operations, longest path, calendars or calendar assignments, and cost loading.
- (5) Any decrease in previously reported activity Earned Amount;
- (6) Pending items and status thereof, including permits, changes orders, and time extensions;
- (7) Status of Contract Completion Date and interim milestones;
- (8) Current and anticipated delays (describe cause of delay and corrective actions(s) and mitigation measures to minimize);
- (9) Description of current and future schedule problem areas.

For each entry in the narrative report, cite the respective Activity ID and Activity Name, the date and reason for the change, and description of the change.

### 1.5 CONTRACT MODIFICATION

Submit a Time Impact Analysis (TIA) with each cost and time proposal for a proposed change. TIA must illustrate the influence of each change or delay on the Contract Completion Date or milestones. No time extensions will be granted nor delay damages paid unless a delay occurs which consumes all available Project Float, and extends the Projected Finish beyond the

## Contract Completion Date.

- a. Each TIA must be in both narrative and schedule form. The narrative must define the scope and conditions of the change; provide start and finish dates of impact, successor and predecessor activity to impact period, responsible party, describe how it originated, and how it impacts the schedule. The schedule submission must consist of three native files:
  - (1) Fragnet used to define the scope of the changed condition
  - (2) Most recent accepted schedule update as of the time of the proposal or claim submission that has been updated to show all activity progress as of the time of the impact start date.
  - (3) The impacted schedule that has the fragnet inserted in the updated schedule and the schedule "run" so that the new completion date is determined.
- b. For claimed as-built project delay, the inserted fragnet TIA method must be modified to account for as-built events known to occur after the data date of schedule update used.
- c. TIAs must include any mitigation, and must determine the apportionment of the overall delay assignable to each individual delay. Apportionment must provide identification of delay type and classification of delay by compensable and non-compensable events. The associated narrative must clearly describe analysis methodology used, and the findings in a chronological listing beginning with the earliest delay event.
  - (1) Identify and classify types of delays as follows:
    - (a) Force majeure delay (e.g. weather delay): Any delay event caused by something or someone other than the Government (including its agents) or the Contractor, or the risk of which has not been assigned solely to the Government or the Contractor. If the force majeure delay is on the critical path, in absence of other types of concurrent delays, the Contractor is granted an extension of contract time, classified as a non-compensable event.
    - (b) A Contractor-delay: Any delay event caused by the Contractor, or the risk of which has been assigned solely to the Contractor. If the contractor-delay is on the critical path, in absence of other types of concurrent delays, Contractor is not granted extension of contract time, and classified as a non-compensable event. Where absent other types of delays, and having impact to project completion, provide a Corrective Action Plan, identifying plan to mitigate delay, to the Contracting Officer.
    - (c) A Government-delay: Any delay event caused by the Government, or the risk of which has been assigned solely to the Government. If the Government-delay is on the longest path, in absence of other types of concurrent delays, the Contractor is granted an extension of contract time, and classified as a compensable event.
  - (2) Use functional theory to analyze concurrent delays, where: Separate delay issues delay project completion, do not necessarily occur at same time, rather occur within same monthly schedule

update period at minimum, or within same as-built period under review. If a combination of functionally concurrent delay types occurs, it is considered Concurrent Delay, which is defined in the following combinations:

(a) Government-delay concurrent with Contractor-delay: Excusable time extension, classified non-compensable event.

(b) Government-delay concurrent with force majeure delay: Excusable time extension, classified non-compensable event.

(c) Contractor-delay concurrent with force majeure delay: Excusable time extension, classified non-compensable event.

(3) A pacing delay, reacting to another delay (parent delay) equally or more critical than paced activity, must be identified prior to pacing. Contracting Officer will notify Contractor prior to pacing. Contractor must notify Contracting Officer prior to pacing. Notification must include identification of parent delay issue, estimated parent delay time period, paced activity(s) identity, and pacing reason(s). Pacing Concurrency is defined as follows:

(a) Government-delay concurrent with Contractor-pacing: Excusable time extension, classified compensable event.

(b) Contractor-delay concurrent with Government-pacing: Inexcusable time extension, classified non-compensable event.

#### 1.6 3-WEEK LOOK AHEAD SCHEDULE

Prepare and issue a 3-Week Look Ahead schedule to provide a more detailed day-to-day plan of upcoming work identified on the Construction Schedule. Key the work plans to activity numbers when a NAS is required and update each week to show the planned work for the current and following two-week period. Additionally, include upcoming outages, closures, preparatory meetings, and initial meetings. Identify critical path activities on the Three-Week Look Ahead Schedule. The detail work plans are to be bar chart type schedules, maintained separately from the Construction Schedule on an electronic spreadsheet program and printed on 8-1/2 by 11 inch sheets as directed by the Contracting Officer. Activities must not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work. Deliver three hard copies and one electronic file of the 3-Week Look Ahead Schedule to the Contracting Officer no later than 8 a.m. each Monday, and review during the weekly QCM Coordination or Production Meeting.

#### 1.7 CORRESPONDENCE AND TEST REPORTS:

Correspondence (e.g., letters, Requests for Information (RFIs), e-mails, meeting minute items, Production and QC Daily Reports, material delivery tickets, photographs) must reference Schedule Activities that are being addressed. Test reports (e.g., concrete, soil compaction, weld, pressure) must reference Schedule Activities that are being addressed.

#### 1.8 ADDITIONAL SCHEDULING REQUIREMENTS

Any references to additional scheduling requirements, including systems to be inspected, tested and commissioned, that are located throughout the

remainder of the Contract Documents, are subject to all requirements of this section.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

## SECTION 01 33 00

## SUBMITTAL PROCEDURES

08/18, CHG 4: 02/21

## PART 1 GENERAL

## 1.1 SUMMARY

## 1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

## 1.1.2 Project Type

## 1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

## 1.2 DEFINITIONS

## 1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

**SD-01 Preconstruction Submittals**

Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract.

For Government approved division 01 preconstruction submittals that are required prior to or commencing with the start of work shall be submitted within 30 calendar days of contract award unless specified elsewhere in the specifications. For contractor approved division 01 submittals that are required prior to or commencing with the start of work shall be submitted within 45 calendar days of contract award unless specified elsewhere in the specifications.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates Of Insurance



Surety Bonds

List Of Proposed Subcontractors

List Of Proposed Products

Baseline Network Analysis Schedule (NAS)

Submittal Register

Schedule Of Prices Or Earned Value Report

Accident Prevention Plan

Work Plan

Quality Control (QC) plan

Environmental Protection Plan

List of hazardous materials to be used on the project, to include AF Form 3952 and manufacturer's MSDS for each material. Prime Contractor is responsible for insuring all sub-contractors comply with this submittal requirement

#### SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

#### SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

#### SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish

standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

#### SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

A code analysis shall be provided by the Contractor prior to Notice to Proceed.

Final design drawings shall be stamped by a Professional Engineer (PE) or Licensed Architect currently registered in the state of Georgia.

#### SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of award for the individual Task Order.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

#### SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits

Text of posted operating instructions

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS) concerning impedances,

hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

#### SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

#### SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

Recovered Materials Estimate and Certification Form (RMECEF) listing all Environmental Protection Agency (EPA) Comprehensive Procurement Guide (CPG) recovered materials used during the execution of the contract.

A DD Form 1354 Transfer and Acceptance of DoD Real Property, shall be submitted at the Pre-Final/Final Inspection stage of construction.

#### 1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

#### 1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to

produce SD-01 submittals.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

##### Submittal Register; G

### 1.4 SUBMITTAL REGISTER

Prepare and maintain submittal register as work progresses. Use electronic submittal register program furnished by the Government or other format indicated in the Task Order or approved by the Contracting Officer. Once a submittal has been approved, this item may be added to the Master Submittal Register if agreed upon by the Contractor and the Government.

The items shall be separated by Construction Specifications Index (CSI) divisions (1-48). The numbering of the items in each division will start at "1" and ascend for each subsequent item. For example, the third item on the Master Submittal Register in Division 12 would be 12-3, and the thirteenth item in Division 4 would be 4-13.

Subsequent submittals may then reference items by number from the Master Submittal Register for approval on the current Task Orders.

The Contractor shall keep a separate book for each installation. The Government will keep up their copy. The Contractor shall provide an updated index sheet to the Government within five (5) working days when an item is added to the list.

### 1.5 SUBMITTAL CLASSIFICATION

#### 1.5.1 Government Approved (G)

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

#### 1.5.2 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

#### 1.5.3 Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. These submittals are for information only and for use as specified in Section 01 33 29 SUSTAINABILITY REPORTING.

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

## 1.6 PREPARATION

### 1.6.1 Transmittal Form

Use the AF IMT 3000 transmittal form for submitting both Government-approved and information-only submittals. Submit in accordance with the instructions on the reverse side of the form. These forms or similar forms will be furnished to the Contractor. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

### 1.6.2 Submittal Format

#### 1.6.2.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

#### 1.6.2.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

- a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.
- b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present shop drawings sized 8 1/2 by 11 inches as part of the bound volume for submittals. Present larger drawings in sets. Submit an electronic copy of drawings in PDF format.

#### 1.6.2.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than 2 inches on the right-hand side of each sheet for the Government disposition stamp.

### 1.6.2.3 Format of SD-03 Product Data

Present product data submittals for each section as a complete, bound volume. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

#### 1.6.2.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

#### 1.6.2.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

#### 1.6.2.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

### 1.6.2.4 Format of SD-04 Samples

#### 1.6.2.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

- c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
- d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
- e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
- g. Sample Panel: 4 by 4 feet, or as agreed upon between Contractor and Contracting Officer.
- h. Sample Installation: 100 square feet, or as agreed upon between Contractor and Contracting Officer.

#### 1.6.2.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

#### 1.6.2.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

#### 1.6.2.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

#### 1.6.2.6 Format of SD-06 Test Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

#### 1.6.2.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

#### 1.6.2.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

##### 1.6.2.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

#### 1.6.2.9 Format of SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

#### 1.6.2.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

#### 1.6.2.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

### 1.6.3 Source Drawings for Shop Drawings

#### 1.6.3.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.



### 1.6.3.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

### 1.6.4 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete PDF document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the DoD SAFE Web Application located at the following website: <https://safe.apps.mil/>

## 1.7 QUANTITY OF SUBMITTALS

### 1.7.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit **one electronic** set of administrative submittals.

#### 1.7.2 Number of SD-02 Shop Drawing Copies

Submit **one copy** of shop drawings requiring review and approval by the Government.

#### 1.7.3 Number of SD-03 Product Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

#### 1.7.4 Number of SD-04 Samples

- a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.
- b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of nonsolid materials.

#### 1.7.5 Number of SD-05 Design Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

#### 1.7.6 Number of SD-06 Test Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.

#### 1.7.7 Number of SD-07 Certificate Copies

Submit in compliance with quantity requirements specified for shop drawings.

#### 1.7.8 Number of SD-08 Manufacturer's Instructions Copies

Submit in compliance with quantity requirements specified for shop drawings.

#### 1.7.9 Number of SD-09 Manufacturer's Field Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

#### 1.7.10 Number of SD-10 Operation and Maintenance Data Copies

Submit **two hard** copies of O&M data to the Contracting Officer for review and approval and **one electronic** copy.

#### 1.7.11 Number of SD-11 Closeout Submittals Copies

Unless otherwise specified, submit two sets of administrative submittals.

#### 1.8 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Provide information-only submittals to the Contracting Officer a minimum of 14 calendar days prior to the Preparatory Meeting for the associated Definable Feature of Work (DFOW). Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

#### 1.9 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register."

##### 1.9.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

##### 1.9.2 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

#### 1.9.3 Contractor Use of Submittal Register

Update the following fields with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

#### 1.9.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

#### 1.9.5 Action Codes

#### 1.9.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

### 1.10 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

#### 1.10.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Government may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

#### 1.10.2 Proposing Variations

When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Contracting Officer, with documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

The Contracting Officer will indicate an approval or disapproval of the variation request; and if not approved as submitted, will indicate the Government's reasons therefore. Any work done before such approval is received is performed at the Contractor's risk."

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

#### 1.10.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

#### 1.10.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 **calendar** days will be allowed for the Government to consider submittals with variations.

### 1.11 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

- a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

- b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."
- c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 14 calendar days after the date of submission.

#### 1.12 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

- a. Note the date on which the submittal was received.
- b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. Electronic copies of the submittal will be retained by the Contracting Officer and electronic copies of the submittal will be returned to the Contractor.

##### 1.12.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.
- b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.
- c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.
- d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with

appropriate action, coordination, or change.

- e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

#### 1.13 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

#### 1.14 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

#### 1.15 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

1.16 WITHHOLDING OF PAYMENT

1.17 CERTIFICATION OF SUBMITTAL DATA

Certify the submittal data as follows on Form ENG 4025: "I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

\_\_\_\_\_NAME OF CONTRACTOR \_\_\_\_\_ SIGNATURE OF CONTRACTOR

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --



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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 11 00	SD-01 Preconstruction Submittals														
			Salvage Plan	1.6	G												
		01 14 00	SD-01 Preconstruction Submittals														
			List of Contact Personnel	1.2.1.1													
		01 32 01.00 10	SD-01 Preconstruction Submittals														
			Project Scheduler Qualifications	1.3	G												
			Preliminary Project Schedule	3.4.1	G												
			Initial Project Schedule	3.4.2	G												
			Periodic Schedule Update	3.6.2	G												
		01 32 16.00 20	SD-01 Preconstruction Submittals														
			Baseline Construction Schedule	1.2	G												
			Baseline Design Schedule	1.2	G												
			SD-07 Certificates														
			Monthly Updates	1.4													
		01 33 00	SD-01 Preconstruction Submittals														
			Submittal Register	1.9	G												
		01 33 29	SD-01 Preconstruction Submittals														
			Sustainability Action Plan	1.4.1	G												
			SD-11 Closeout Submittals														
			Final High Performance and Sustainable Building Checklist	1.5.3.2	G												
			Final Sustainability eNotebook	1.5.3.2	G												
		01 35 13	SD-01 Preconstruction Submittals														
			Heavy Equipment and Vehicle List	3.1.4													
			FAA Form 7460-1	3.1.2													

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		01 35 13	FAA Form 7460-2	3.1.2													
			Construction Operations Plan	3.1.3.1													
		01 35 26	SD-01 Preconstruction Submittals														
			APP - Construction	1.7.1	G												
			Dive Operations Plan		G												
			Accident Prevention Plan (APP)	1.7	G												
			SD-06 Test Reports														
			Monthly Exposure Reports	1.4													
			Notifications and Reports	1.12													
			Accident Reports	1.12.2	G												
			LHE Inspection Reports	1.12.3													
			SD-07 Certificates														
			Crane Operators/Riggers	1.6.1.5													
			Standard Lift Plan	1.7.3.2	G												
			Critical Lift Plan	1.7.3.3	G												
			Naval Architecture Analysis	1.7.3.4	G												
			Activity Hazard Analysis (AHA)	1.8													
			Confined Space Entry Permit	1.9.1													
			Hot Work Permit	1.9.1													
			Certificate of Compliance	1.12.4													
			License Certificates	1.14													
			Radiography Operation Planning	1.14.1	G												
			Work Sheet														
			Portable Gauge Operations	1.14.1	G												
			Planning Worksheet														
		01 45 00.00 10	SD-01 Preconstruction Submittals														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 45 00.00 10	Contractor Quality Control (CQC) Plan	3.2	G												
			SD-06 Test Reports														
			Verification Statement	3.9.2													
		01 45 35	SD-01 Preconstruction Submittals														
			SIOR Letter of Acceptance		G												
			Project Manual		G												
			Written NDT Practices														
			SD-06 Test Reports														
			Daily Reports	3.1.2													
			Biweekly Reports	3.1.1													
			SD-07 Certificates														
			AISC Certified Steel Fabricator	2.1													
			Steel Truss Plant Quality Assurance Program	2.1													
			Wood Truss Plant Quality Assurance Program	2.1													
			AC472 Accreditation	2.1													
			Steel Joist Institute Membership	2.1													
			Certified Plant	2.1													
			Certificate of Compliance	2.1													
			Special Inspector of Record	1.5.17	G												
			Special Inspector	1.5	G												
			Qualification Records														
			SD-11 Closeout Submittals														
			Interim Report		G												

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		01 45 35	Comprehensive Final Report	3.1.2	G												
		01 50 00	SD-01 Preconstruction Submittals														
			Construction Site Plan	1.3	G												
			Traffic Control Plan	3.4.1	G												
			Haul Road Plan	2.2.1	G												
			Contractor Computer Cybersecurity Compliance Statements	1.6.1.4	G												
			Contractor Temporary Network Cybersecurity Compliance Statements	1.6.6	G												
			SD-06 Test Reports														
			Backflow Preventer Tests	3.5													
			SD-07 Certificates														
			Backflow Tester	1.4.1													
			Backflow Preventers	1.4													
		01 57 19	SD-01 Preconstruction Submittals														
			Preconstruction Survey	1.6.1													
			Solid Waste Management Permit	1.10	G												
			Regulatory Notifications	1.6.2	G												
			Environmental Protection Plan	1.7	G												
			Dirt and Dust Control Plan	1.7.9.1	G												
			Employee Training Records	1.6.4													
			Environmental Manager Qualifications														
			SD-06 Test Reports														

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		01 57 19	Monthly Solid Waste Disposal Report	1.10.1	G												
			SD-07 Certificates														
			Employee Training Records	1.6.4													
			Certificate of Competency														
			Erosion and Sediment Control Inspector	1.6.4													
			SD-11 Closeout Submittals														
			Waste Determination Documentation	3.7.1	G												
			Disposal Documentation for Hazardous and Regulated Waste	3.7.3.6	G												
			Assembled Employee Training Records	1.6.4													
			Solid Waste Management Permit	1.10	G												
			Project Solid Waste Disposal Documentation Report	3.7.2.1	G												
			Hazardous Waste/Debris Management	3.7.3.1	G												
			Regulatory Notifications	1.6.2	G												
			Sales Documentation	3.7.2.1	G												
		01 74 19	SD-01 Preconstruction Submittals														
			Construction Waste Management Plan	1.6	G												
			SD-06 Test Reports														
			Quarterly Reports														

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		01 74 19	Annual Report														
			SD-11 Closeout Submittals														
			Final Construction Waste	1.9	S												
			Diversion Report														
		01 78 00	SD-03 Product Data														
			Warranty Management Plan	1.7.1													
			Warranty Tags	1.7.5													
			Spare Parts Data	1.5													
			SD-08 Manufacturer's Instructions														
			Instructions	1.7.1													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.5	G												
			Manuals														
			SD-11 Closeout Submittals														
			As-Built Drawings	3.1	G												
			Record Drawings	3.3	G												
			As-Built Record of Equipment	1.7.1													
			and Materials														
			Certification of EPA Designated														
			Items														
			Interim DD FORM 1354	3.7.1	G												
			Checklist for DD FORM 1354	3.7.2	G												
		01 78 23	SD-10 Operation and Maintenance														
			Data														
			O&M Database		G												

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 78 23	Training Plan	3.1.1	G												
			Training Outline	3.1.3	G												
			Training Content	3.1.2	G												
			SD-11 Closeout Submittals														
			Training Video Recording	3.1.4	G												
			Validation of Training Completion	3.1.6	G												
		02 32 13	SD-02 Shop Drawings														
			Drilling Log	3.11	G												
			SD-03 Product Data														
			Permits, Certifications, and Licenses	1.5													
			Schedule of Drilling, Sampling, and Testing	1.3.7.1	G												
		02 41 00	SD-01 Preconstruction Submittals														
			Demolition Plan	1.2.2	G												
			Existing Conditions	1.11													
			SD-07 Certificates														
			Notification	1.7	G												
			Notification of Demolition and Renovation Form														
			SD-11 Closeout Submittals														
			Receipts	3.3.4													
		02 42 51	SD-01 Preconstruction Submittals														
			Dust-Control Measures	1.4.2	G												
			Packing and Transportation Measures	1.4.2	G												

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02 42 51	Schedule of Carpet Reclamation Activities	1.4.4	G												
			Carpet Reclamation Agency Records	1.4.3	G												
		02 61 13	SD-01 Preconstruction Submittals Work Plan	1.3	G												
			SD-02 Shop Drawings														
			Surveys	3.1													
			SD-06 Test Reports														
			Compaction	3.9.2													
			Closure Report	3.11	G												
		02 65 00	SD-01 Preconstruction Submittals Work Plan	1.5.4	G												
			Site Safety and Health Plan	1.5.4.1	G												
			Excavation and Material Handling Plan	1.5.4.2	G												
			Field Sampling and Laboratory Testing Plan	1.5.4.3	G												
			Tank and Piping Removal And Disposal Plan	1.5.4.4	G												
			Spill and Discharge Control Plan	1.5.4.5	G												
			Qualifications	1.5.1	G												
			Laboratory Services	1.5.2	G												
			State Licensed Waste Transporter														
			SD-06 Test Reports														



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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02 65 00	Laboratory and Field Testing Reports	3.15													
			Backfill Material	2.1													
			Tank Contents Verification	3.2													
			Contaminated Water Disposal	3.5.2													
			Soil Examination, Testing, and Analysis	3.10													
			Backfilling	3.11	G												
			SD-11 Closeout Submittals														
			Salvage Rights	3.12.4	G												
			Tank Closure Report	3.15													
		02 81 00	SD-03 Product Data														
			Packaging Notifications	2.1.1													
			Hazardous Waste Management Plan	3.1	G												
			Onsite Hazardous Waste Management	3.2	G												
			Notices of Non-Compliance and Notices of Violation	3.3													
			SD-06 Test Reports														
			Recordkeeping	3.7	G												
			Exception Report	3.7	G												
			Spill Response	3.8													
			SD-07 Certificates														
			Transportation and Disposal Coordinator	1.4.1	G												

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		02 81 00	Training	1.4.2	G												
			Certification	1.4.3													
			Shipping Documents and Packagings Certification	3.3.3	G												
			Security Plan	3.3.4													
			Certificates of Disposal	3.3.5													
			Waste Minimization	3.6													
		02 82 00	SD-03 Product Data														
			Amended Water	1.2.2	G												
			Safety Data Sheets (SDS) for All Materials	1.3.9	G												
			Encapsulants	2.1	G												
			Respirators	3.1.2.1	G												
			Local Exhaust Equipment	3.1.7	G												
			Pressure Differential Automatic Recording Instrument	3.1.7	G												
			Vacuums	3.1.8	G												
			Glovebags	3.1.10	G												
			SD-06 Test Reports														
			Air Sampling Results	1.5.5	G												
			Pressure Differential Recordings for Local Exhaust System	1.5.6	G												
			Encapsulation Test Patches	3.2.12.2	G												
			Clearance Sampling	3.2.14.5	G												
			Asbestos Disposal Quantity Report	3.3.3.2	G												

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		02 82 00	SD-07 Certificates														
			Employee Training	1.3.4	G												
			Notifications	1.3.5	G												
			Respiratory Protection Program	1.3.7	G												
			Asbestos Hazard Abatement Plan	1.3.10	G												
			Testing Laboratory	1.3.11	G												
			Landfill Approval	1.3.12	G												
			Delivery Tickets	1.3.12	G												
			Waste Shipment Records	1.3.12	G												
			Transporter Certification	1.3.13	G												
			Medical Certification	1.3.14	G												
			Private Qualified Person Documentation	1.5.1	G												
			Designated Competent Person	1.5.2	G												
			Worker's License	1.5.3	G												
			Contractor's License	1.5.4	G												
			Federal, State or Local Citations on Previous Projects	1.5.9	G												
			Encapsulants	2.1	G												
			Equipment Used to Contain Airborne Asbestos Fibers	3.1	G												
			Water Filtration Equipment	3.1.3.3	G												
			Vacuums	3.1.8	G												
			Ventilation Systems	3.1.8	G												
			SD-11 Closeout Submittals														

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		02 82 00	Permits[ and Licenses]	1.3.5	G												
			Notifications	1.3.5	G												
			Respirator Program Records	1.3.7.1	G												
			Protective Clothing	1.5.7	G												
			Decontamination Quality Control Records														
			Protective Clothing	1.5.8	G												
			Decontamination Facility Notification														
			Rental Equipment	1.7.1	G												
		02 83 00	SD-01 Preconstruction Submittals														
			Competent Person	1.5.1.1	G												
			Training Certification	1.5.1.2	G												
			Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			Medical Examinations	1.5.2.4	G												
			Lead, Cadmium, Chromium	1.5.2.8	G												
			Waste Management Plan														
			Licenses, Permits and Notifications	1.5.4	G												
			Occupant Protection Plan	1.5.5	G												
			Lead, Cadmium, Chromium	1.5.2.2	G												
			Compliance Plan														
			Lead, Cadmium, Chromium	3.1.1.6	G												
			Compliance Plan														
			Initial Sample Results	3.4.1.1	G												

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		02 83 00	Written Evidence of TSD Approval	3.5.2.1	G												
			SD-03 Product Data														
			Respirators	1.6.1	G												
			Vacuum Filters	1.6.4	G												
			Negative Air Pressure System	1.6.7	G												
			Materials and Equipment	2.1	G												
			Expendable Supplies	2.1.1	G												
			Local Exhaust Equipment	3.1.1.5	G												
			Pressure Differential Automatic Recording Instrument	3.1.1.5	G												
			Pressure Differential Log	3.1.1.6	G												
			SD-06 Test Reports														
			Sampling and Analysis	1.3.3	G												
			Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			Sampling Results	1.5.2.3	G												
			Pressure Differential Recordings For Local Exhaust System	1.5.3	G												
			SD-07 Certificates														
			Testing Laboratory	1.5.1.3	G												
			Third Party Consultant Qualifications	1.5.1.4	G												
			Occupant Notification	3.1.1.1	G												

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		02 83 00	Notification of the Commencement of LBP Hazard Abatement	3.1.1.1	G												
			Clearance Certification	3.5.1.1	G												
			SD-11 Closeout Submittals														
			Hazardous Waste Manifest	3.5.2.1	G												
			Turn-In Documents or Weight Tickets	3.5.2.1	G												
		02 84 16	SD-07 Certificates														
			Qualifications of CIH	1.8.1	G												
			Training Certification	1.8.1	G												
			PCB and Lamp Removal Work Plan	1.8.2	G												
			PCB and Lamp Disposal Plan	1.8.3	G												
			SD-11 Closeout Submittals														
			Transporter Certification	3.5.2	G												
			Certification of Decontamination	3.2.4													
			Certificate of Disposal and/or recycling	3.5.2.1													
			DD Form 1348-1														
			Testing Results														
		02 85 00	SD-01 Preconstruction Submittals														
			Ventilation System Mold	1.2.26	G												
			Remediator Qualifications														
			Preliminary Visual Assessment Report	1.4.1.1	G												

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		02 85 00	Microbial Remediation Plan	1.4.1.2	G												
			Respiratory Protection Program	1.4.1.3	G												
			Worker Records	1.4.1.4													
			Certified Industrial Hygienist (CIH)/Industrial Hygienist (IH) Qualifications	1.4.1.5	G												
			Microbial Remediation Supervisor Qualifications	1.4.1.6	G												
			SD-03 Product Data														
			Disinfectants or Biocide Sanitizing Solutions	1.2.11	G												
			Fungicidal Agents, (EPA)	1.2.14	G												
			Personal Protective Equipment (PPE)	1.2.21	G												
			Pressure Differential Measuring Instrument	1.2.24													
			Safety Data Sheets (SDS) for All Materials	2.2	G												
			Dehumidifiers	3.1.4													
			Air Filtration Units	3.1.5													
			SD-06 Test Reports														
			IH Daily Reports	1.4.3	G												
			SD-11 Closeout Submittals														
			Submittals at Completion of Remediation Work	1.4.4	G												
		03 30 00	SD-01 Preconstruction Submittals														

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		03 30 00	Quality Control Plan	1.6.6	G												
			Quality Control Personnel Certifications	1.6.7	G												
			Quality Control Organizational Chart	1.6.7													
			Laboratory Accreditation	1.6.9	G												
			Maturity Method Data	3.3.10													
			SD-02 Shop Drawings														
			Reinforcing Steel	1.6.2.1	G												
			SD-03 Product Data														
			Joint Sealants	2.4.5													
			Joint Filler	2.4.4													
			Formwork Materials	2.1													
			Recycled Aggregate Materials	2.3.3.3													
			Cementitious Materials	2.3.1													
			Vapor Retarder and Vapor Barrier	2.4.6													
			Concrete Curing Materials	2.4.1													
			Reinforcement	2.6													
			Liquid Chemical Floor Hardeners and Sealers	2.4.3.1													
			Admixtures	2.3.4													
			Reinforcing Fibers	2.6.6													
			Mechanical Reinforcing Bar Connectors	2.6.2													
			Waterstops	2.2.2													



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		03 30 00	Local/Regional Materials	1.8.1													
			Biodegradable Form Release Agent	2.2.3													
			Pumping Concrete	1.6.3.1													
			Finishing Plan														
			Nonshrink Grout	2.4.2													
			SD-04 Samples														
			Slab Finish Sample	1.6.5.1													
			Surface Finish Samples	1.6.5.2													
			SD-05 Design Data														
			Concrete Mix Design	1.6.1.1	G												
			SD-06 Test Reports														
			Concrete Mix Design	1.6.1.1	G												
			Fly Ash	1.6.4.1													
			Pozzolan	1.6.4.1													
			Slag Cement	1.6.4.2													
			Aggregates	1.6.4.3													
			Fiber-Reinforced Concrete	1.6.4.4	G												
			Tolerance Report	3.10.2.1													
			Compressive Strength Tests	3.14.3.3	G												
			Unit Weight of Structural Concrete														
			Chloride Ion Concentration														
			Air Content														
			Slump Tests	3.14.3.1													
			Water	2.3.2													

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		03 30 00	SD-07 Certificates														
			Reinforcing Bars	2.6.1													
			Welder Qualifications	1.9													
			Silica Fume Manufacturer's Representative	1.6.3.2													
			VOC Content for Form Release Agents, Curing Compounds, and Concrete Penetrating Sealers	1.6.3.3													
			Safety Data Sheets	1.6.3.4													
			Forest Stewardship Council (FSC) Certification	1.8.2													
			Field Testing Technician and Testing Agency	1.6.7.2													
			SD-08 Manufacturer's Instructions														
			Liquid Chemical Floor Hardeners and Sealers	2.4.3.1													
			Joint Sealants	2.4.5													
			Curing Compound	2.4.1													
		03 30 53	SD-02 Shop Drawings														
			Installation Drawings	1.5	G												
			SD-03 Product Data														
			Air-Entraining Admixture	2.2.3.1													
			Accelerating Admixture														
			Water-Reducing or Retarding Admixture	2.2.3.2													
			Curing Materials	2.2.11													

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		03 30 53	Expansion Joint Filler Strips, Premolded	2.2.6													
			Joint Sealants - Field Molded Sealants	2.2.7													
			Waterstops	2.4.1													
			Chemical Floor Hardener	2.4.2													
			Batching and Mixing Equipment	3.1.4.3													
			Conveying and Placing Concrete Formwork	3.2 2.2.8													
			Mix Design Data	2.3	G												
			Ready-Mix Concrete	2.3													
			Curing Compound	2.4.3													
			Mechanical Reinforcing Bar Connectors	2.2.5													
			SD-06 Test Reports														
			Aggregates	2.2.2													
			Concrete Mixture Proportions	2.1.3	G												
			Measurement of Floor Tolerances	3.3.3.2													
			Compressive Strength Testing	3.9.3	G												
			Slump	3.9.3	G												
			Air Content	3.9.3													
			Water	2.2.4													
			SD-07 Certificates														
			Cementitious Materials	2.2.1													
			Pozzolan	2.2.1.2													

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		03 30 53	CPG for recycled materials or appropriate Waiver Form														
			Aggregates	2.2.2													
			Delivery Tickets	2.3													
			SD-08 Manufacturer's Instructions														
			Chemical Floor Hardener	2.4.2													
			Curing Compound	2.4.3													
		03 33 00	SD-02 Shop Drawings														
			Detail Drawings	1.4.1													
			SD-04 Samples														
			Materials	2.1													
			Panels	1.4.2													
		03 42 13.00 10	SD-01 Preconstruction Submittals														
			Quality Control Procedures	1.3.2.2													
			SD-02 Shop Drawings														
			Standard Precast Units	2.1.1	G												
			Custom-Made Precast Units	2.1.2	G												
			Special Finishes	3.2.4.3													
			SD-03 Product Data														
			Standard Precast Units	2.1.1													
			Proprietary Precast Units	2.1.3													
			Embedded Items	3.1.3													
			Accessories	2.2.6													
			SD-05 Design Data														
			Design Calculations	2.1.2													
			Concrete Mix Proportions	2.1.5.1													

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		03 42 13.00 10	SD-06 Test Reports														
			Test Reports	1.3.2.4													
			SD-07 Certificates														
			Quality Control Procedures	1.3.2.2													
			SD-11 Closeout Submittals														
			Recycled content for fly ash and pozzolan	2.2.1	S												
			Recycled content for Ground Iron Blast-Furnace Slag	2.2.1	S												
			Recycled content for Silica Fume	2.2.1	S												
			Recycled content for Synthetic Fiber Reinforcement	2.2.1	S												
			Recycled content for steel	2.2.1	S												
		05 05 23.16	SD-01 Preconstruction Submittals														
			Welding Quality Assurance Plan	3.2	G												
			SD-03 Product Data														
			Welding Procedure Qualifications	1.3	G												
			Welder, Welding Operator, and Tacker Qualification	1.3.4													
			Previous Qualifications	1.3.2													
			Pre-Qualified Procedures	1.3.3	G												
			Welding Electrodes and Rods	2.2													
			SD-06 Test Reports														
			Nondestructive Testing	3.3													
			Weld Inspection Log	3.2													
			SD-07 Certificates														

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		05 05 23.16	Certified Welding Procedure Specifications (WPS)	1.3.1													
			Certified Brazing Procedure Specifications (BPS)	1.3.1													
			Certified Procedure Qualification Records (PQR)	1.3.1													
			Certified Welder Performance Qualifications (WPQ)	1.3.1													
			Certified Brazer Performance Qualifications (BPQ)	1.3.1													
			Certified Welding Inspector	1.3.5													
			Nondestructive Testing Personnel	1.3.5													
		05 12 00	SD-01 Preconstruction Submittals														
			Erection and Erection Bracing Drawings	1.5.1.1	G												
			SD-02 Shop Drawings														
			Fabrication Drawings	1.5.2	G												
			SD-03 Product Data														
			Shop Primer	2.6.2													
			Welding Electrodes and Rods	2.4.1													
			Direct Tension Indicator Washers	2.3.2.3													
			Non-Shrink Grout	2.4.2													
			Tension Control Bolts	2.3.3													
			Recycled Content for Structural Steel	2.2.1	S												

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		05 12 00	Recycled Content for Structural Steel Tubing	2.2.2	S												
			Recycled Content for Steel Pipe	2.2.3	S												
			SD-05 Design Data														
			Design Calculations for Steel Connections		G												
			SD-06 Test Reports														
			Class B Coating	2.6.2													
			Bolts, Nuts, and Washers	2.3													
			Weld Inspection Reports	3.7.1.2													
			Direct Tension Indicator Washer Inspection Reports	3.7.2.1													
			Bolt Testing Reports	3.7.3.1													
			SD-07 Certificates														
			Steel	2.2													
			Bolts, Nuts, and Washers	2.3													
			Galvanizing	2.5													
			AISC Structural Steel Fabricator Quality Certification	1.3													
			AISC Structural Steel Erector Quality Certification	1.3													
			Welding Procedures and Qualifications	1.5.3.1													
			Welding Electrodes and Rods	2.4.1													
			Certified Welding Inspector	3.7.1.1													
			NDT Technician	3.7.1.2													

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		05 12 00	Welding Procedure Specifications (WPS)	3.4													
			Overhead, Top Running Crane Rail Beam	1.5.3.2													
		05 21 00	SD-01 Preconstruction Submittals														
			Welder Qualification	1.3.2													
			SD-02 Shop Drawings														
			Steel Joist Framing	1.3.1	G												
			SD-03 Product Data														
			Recycled Content Of Steel Products	2.3	S												
			SD-05 Design Data														
			Design Calculations	2.2	G												
			SD-06 Test Reports														
			Erection Inspection	3.4													
			Welding Inspections	3.4													
			SD-07 Certificates														
			Certification of Compliance	1.3.2													
		05 30 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.3.5	G												
			SD-03 Product Data														
			Accessories	2.2													
			Deck Units	2.1													
			Galvanizing Repair Paint	2.1.9													
			Mechanical Fasteners	2.2.18													
			Touch-Up Paint	2.1.9													



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		05 30 00	Sound Absorbing Materials	2.1.2													
			Welding Equipment	1.3.3													
			Welding Rods and Accessories	1.3.3													
			Recycled Content of Steel Products	2.1	S												
			SD-04 Samples														
			Metal Roof Deck Units	2.1.1													
			Cellular Metal Floor Deck Units	2.1.4													
			Flexible Closure Strips	2.2.4													
			Acoustical Material	2.2.17													
			SD-05 Design Data														
			Deck Units	2.1	G												
			SD-07 Certificates														
			Powder-Actuated Tool Operator	1.3.2													
			Welder Qualifications	1.3.3													
			Welding Procedures	1.3.3													
			Fire Safety	1.3.4.1													
			Wind Storm Resistance	1.3.4.2													
			Manufacturer's Certificate	1.3.1													
			Stud Manufacture's Certification	2.2.12													
			Stud Manufacture's Test Reports	2.2.12													
		05 40 00	SD-02 Shop Drawings														
			Framing Components	1.6.1	G												
			SD-03 Product Data														
			Studs, Joists	2.1													

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		05 40 00	Recycled Content of Steel Products	2.1	S												
			SD-05 Design Data														
			Metal Framing Calculations	1.6.2	G												
			SD-07 Certificates														
			Load-Bearing Cold-Formed Metal Framing	1.4													
			Welds	3.2.1													
		05 50 13	SD-02 Shop Drawings														
			Structural Steel Door Frames	2.14	G												
			Cover Plates and Frames	2.5	G												
			Expansion Joint Covers	2.6	G												
			Floor Gratings	2.7	G												
			Roof Walkways	2.7	G												
			Bollards/Pipe Guards	2.8	G												
			Wheel Guards	2.15	G												
			Window and Door Guards	2.17	G												
			Angles and Plates	2.10	G												
			Roof Hatches	2.16	G												
			SD-03 Product Data														
			Corner Guards	2.4													
			Cover Plates and Frames	2.5	G												
			Expansion Joint Covers	2.6	G												
			Floor Gratings	2.7	G												
			Roof Walkways	2.7	G												
			Structural Steel Door Frames	2.14	G												

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		05 50 13	Wheel Guards	2.15													
			Window and Door Guards	2.17	G												
			Roof Hatches	2.16	G												
			Downspout Terminations	2.9	G												
			Recycled Content	2.1	S												
			SD-04 Samples														
			Expansion Joint Covers	2.6													
			Certificates of Compliance	2.1	G												
			Certified Mill	2.2	G												
		05 50 14	SD-02 Shop Drawings														
			Detail Drawings	1.3.1	G												
			Welding Procedures	2.1.2.1.1	G												
			Welding Repair Plan	2.2.4													
			Castings	2.1.6													
			SD-03 Product Data														
			Filler Metal	2.1.2.1.3.1													
			Lubricant	2.1.8.3													
			SD-06 Test Reports														
			Tests, Inspections, and Verifications	2.2													
			SD-07 Certificates														
			Welding Qualifications	1.3.2													
			Application Qualification for Steel Studs	2.1.2.3.1	G												
			Welding of Aluminum	2.1.2.4													
			Weld Inspection Log	2.2.3.1													

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		05 50 14	Certified Welding Inspector	2.2.3.1													
			Nondestructive Testing Personnel	2.2.3.2.1													
		05 51 00	SD-02 Shop Drawings														
			Iron and Steel Hardware	2.1	G												
			Steel Shapes, Plates, Bars, and Strips	2.1	G												
			Metal Stair System	2.2.1	G												
			SD-03 Product Data														
			Structural Steel Plates, Shapes, and Bars	2.4.1	G												
			Structural Steel Tubing	2.4.2	G												
			Hot-Rolled Carbon Steel Sheets and Strips	2.4.5	G												
			Cold-Finished Steel Bars	2.4.4	G												
			Hot-Rolled Carbon Steel Bars	2.4.3	G												
			Cold-Rolled Carbon Steel Sheets	2.4.6	G												
			Galvanized Carbon Steel Sheets	2.4.7	G												
			Cold-Drawn Steel Tubing	2.4.8	G												
			Gray Iron Castings	2.4.9	G												
			Malleable Iron Castings	2.4.10	G												
			Concrete Inserts	2.3.4	G												
			Masonry Anchorage Devices	2.3.5	G												
			Protective Coating	2.2.4	G												
			Steel Pan Stairs	2.2.2	G												
			Steel Stairs	2.3.1	G												

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		05 51 00	Steel Stairs, Circular	2.3.2	G												
			SD-07 Certificates														
			Welding Procedures	1.3.1	G												
			Welder Qualification	1.3.1	G												
			SD-08 Manufacturer's Instructions														
			Structural Steel Plates, Shapes, and Bars	2.4.1	G												
			Structural Steel Tubing	2.4.2	G												
			Hot-Rolled Carbon Steel Sheets and Strips	2.4.5	G												
			Cold-Finished Steel Bars	2.4.4	G												
			Hot-Rolled Carbon Steel Bars	2.4.3	G												
			Cold-Rolled Carbon Steel Sheets	2.4.6	G												
			Galvanized Carbon Steel Sheets	2.4.7	G												
			Cold-Drawn Steel Tubing	2.4.8	G												
			Gray Iron Castings	2.4.9	G												
			Malleable Iron Castings	2.4.10	G												
			Protective Coating	2.2.4	G												
			Masonry Anchorage Devices	2.3.5	G												
		05 51 33	SD-02 Shop Drawings														
			Ladders	2.3													
			Ship's Ladder	2.3.3													
			SD-03 Product Data														
			Ladders	2.3													
			Ship's Ladder	2.3.3													
			Ladder Safety Devices	2.3.2													

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		05 51 33	SD-07 Certificates														
			Fabricator Certification for Ladder Assembly	1.3													
			Fabricator Certification for Ships Ladder Assembly	1.3													
		05 52 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.2.1	G												
			Iron and Steel Hardware	3.2	G												
			Steel Shapes, Plates, Bars and Strips	3.2	G												
			SD-03 Product Data														
			Structural-Steel Plates, Shapes, and Bars	2.2.1	G												
			Structural-Steel Tubing	2.2.2	G												
			Cold-Finished Steel Bars	2.2.4	G												
			Hot-Rolled Carbon Steel Bars	2.2.3	G												
			Cold-Drawn Steel Tubing	2.2.5	G												
			Concrete Inserts	2.2.7	G												
			Masonry Anchorage Devices	2.2.8	G												
			Protective Coating	2.1.3	G												
			Steel Railings and Handrails	2.2.10	G												
			Aluminum Railings and Handrails	2.2.11	G												
			Anchorage and Fastening Systems	1.2.1	G												
			SD-07 Certificates														
			Welding Procedures	1.4.1	G												

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		05 52 00	Welder Qualification	1.4.2	G												
			SD-08 Manufacturer's Instructions														
			Installation Instructions	3.2													
		05 59 10	SD-01 Preconstruction Submittals														
			Assembly Tests	2.6.2	G												
			Acceptance Testing	3.3	G												
			SD-02 Shop Drawings														
			Detail Drawings	1.4.3	G												
			SD-03 Product Data														
			Wheel Assemblies	2.1.7	G												
			Materials List	1.4.3	G												
			Welding	2.4	G												
			Welding of Aluminum	2.4.2	G												
			Steel Welding Repairs	2.4.4	G												
			SD-07 Certificates														
			Welder Qualifications	1.4.1													
			Welding of Aluminum	2.4.2													
		05 72 00	SD-01 Preconstruction Submittals														
			Existing Conditions	1.3.4	G												
			SD-02 Shop Drawings														
			Ornamental Metal Items	2.2	G												
			Installation Drawings	3.1	G												
			Shop and Field Connections	3.1	G												
			Construction Details	3.1	G												
			SD-03 Product Data														
			Materials	2.1	G												

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		05 72 00	Ornamental Metal Items	2.2	G												
			Aluminum-Alloy Extrusions	2.2.2													
			Aluminum-Alloy Sheets And Plates	2.2.3													
			Aluminum-Alloy Castings	2.2.4													
			Aluminum-Alloy Forgings	2.2.5													
			SD-04 Samples														
			Manufacturer's Standard Color Charts	1.3.2	G												
			Shop Paint	1.3.2	G												
			Finish Paint	1.3.2	G												
			Aluminum Finishes	1.3.1	G												
			Aluminum Finishes	2.2.9	G												
			Anchorage Devices and Fasteners	1.3.1	G												
			SD-06 Test Reports														
			Welding Tests	1.3.3	G												
			SD-07 Certificates														
			Welding Procedures	1.3.3													
			Ornamental Metal Items	2.2	G												
			Welder Qualifications	1.3.3													
			SD-08 Manufacturer's Instructions														
			Cleaning Materials	3.3													
			Preventative Maintenance and Inspection	3.3													
			Maintenance Instructions	3.4													



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		05 72 00	Application Methods	3.3													
		06 10 00	SD-02 Shop Drawings														
			Structural Glued Laminated	2.2.3	G												
			Trussed Rafters	2.5.7	G												
			Trussed Joists	2.5.8	G												
			Fabricated Structural Members	1.9.1	G												
			Modifications of Structural Members	1.9.2	G												
			Nailing Strips	2.2.2	G												
			SD-03 Product Data														
			Salvaged Lumber	2.1.2													
			Recovered Lumber	2.1.3													
			Underlayment	2.4													
			Plastic Lumber	2.1.5													
			Fiberboard Wall Sheathing	2.5.2													
			Cellulose Honeycomb Panels	2.5.5													
			Fire-retardant Treatment	1.8													
			Structural-use and OSB Panels	1.4.4													
			Structural-use and OSB Panels	2.3.3.2													
			Oriented Strand Board	2.3													
			Adhesives	2.5.11													
			Biobased Content for Strawboard Panels	2.4.6	S												
			Biobased Content for Cork Underlayment	2.4.7	S												

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		06 10 00	Recycled Content for Plastic Lumber	2.1.5	S												
			Recycled Content for Fiberboard Underlayment	2.4.5	S												
			Recycled Content for Cork Underlayment	2.4.7	S												
			Recycled Content for Fiberboard Wall Sheathing	2.5.2	S												
			Recycled Content for Cellulose Honeycomb Panels	2.5.5	S												
			SD-05 Design Data														
			Modifications of Structural Members	1.9.2	G												
			SD-06 Test Reports														
			Preservative-treated	1.4.5													
			SD-07 Certificates														
			Certificates of Grade	1.11.1													
			Certified Sustainably Harvested Virgin Lumber	2.1.1	S												
			Certified Sustainably Harvested Natural-decay and Insect-resistant Wood	2.1.4	S												
			Certified Sustainably Harvested Framing Lumber	2.2.2	S												

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		06 10 00	Certified Sustainably Harvested Structural Glued Laminated Timber	2.2.3	S												
			Certified Sustainably Harvested Plywood Subflooring	2.3.1.1	S												
			Certified Sustainably Harvested Structural-use and OSB Panel Subfloor Sheathing	2.3.1.2	S												
			Certified Sustainably Harvested Plywood Combination Subfloor Underlayment	2.3.2.1	S												
			Certified Sustainably Harvested Plywood Wall Sheathing	2.3.3.1	S												
			Certified Sustainably Harvested Structural-use and OSB Panel Wall Sheathing	2.3.3.2	S												
			Certified Sustainably Harvested Plywood Roof Sheathing	2.3.4.1	S												
			Certified Sustainably Harvested Plywood Diaphragm	2.3.5.1	S												
			Certified Sustainably Harvested Structural-use and OSB Panel Diaphragm	2.3.5.2	S												
			Certified Sustainably Harvested Plywood Shear Wall	2.3.6.1	S												

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		06 10 00	Certified Sustainably Harvested Structural-use and OSB Panel Shear Wall	2.3.6.2	S												
			Certified Sustainably Harvested Plywood for Other Uses	2.3.7.1	S												
			Certified Sustainably Harvested Structural-use and OSB Panels for Other Uses	2.3.7.2	S												
			Certified Sustainably Harvested Plywood Underlayment	2.4.3	S												
			Preservative Treatment	1.7													
			Indoor Air Quality for Particleboard Underlayment	2.4.2	S												
			Indoor Air Quality for Fiberboard Underlayment	2.4.5	S												
			Indoor Air Quality for Strawboard Panels	2.4.6	S												
			Indoor Air Quality for Fiberboard Wall Sheathing	2.5.2	S												
			Indoor Air Quality for Aerosol Adhesives	2.5.11	S												
			Indoor Air Quality for Non-aerosol Adhesives	2.5.11	S												
			SD-10 Operation and Maintenance Data														
			Plastic	1.4.8													

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		06 10 00	Take-back Program	3.6													
		06 18 00	SD-02 Shop Drawings														
			Fabrication Drawings	2.1.1													
			Installation Drawings	3.1.2	G												
			SD-04 Samples														
			Exposed-to-View Surfaces	1.3.3	G												
			SD-07 Certificates														
			Glued-Laminated Structural Members	1.3.2													
			Structural Members	1.3.2													
			Design Load Compliance	1.3.2													
			SD-08 Manufacturer's Instructions														
			Laminated Wood Materials	3.1.1													
			Adhesive	3.1.1													
		06 20 00	SD-02 Shop Drawings														
			Detail Drawings Indicating All Wood Assemblies	1.3	G												
			SD-03 Product Data														
			Wood Products	2.1	G												
			Countertops	2.4	G												
			Engineered	2.1.14.8	G												
			Treated Wood Products	1.4	G												
			Soffits	2.2	G												
			Fascias and Trim	2.3	G												
			Hardware and Accessories	2.8	G												
			VOC Content for Siding	2.1.14	S												

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		06 20 00	Recycled Content for MDF/Particleboard	2.1.8	S												
			SD-04 Samples														
			Samples	1.5	G												
			SD-07 Certificates														
			Certificates of Grade	1.7.1.1	G												
			Certified Sustainably Harvested Wood for Trim and Frames	2.1.3	S												
			Certified Sustainably Harvested Softwood Plywood	2.1.5	S												
			Certified Sustainably Harvested Hardwood Plywood	2.1.6	S												
			Certified Sustainably Harvested Hardboard	2.1.7	S												
			Certified Sustainably Harvested Siding	2.1.14	S												
			Indoor Air Quality for Hardwood Plywood	2.1.6	S												
			Indoor Air Quality for MDF and Particleboard	2.1.8	S												
			Indoor Air Quality for Non-aerosol Adhesives	2.9.1.2	S												
			Indoor Air Quality for Aerosol Adhesives	2.9.1.2	S												
		06 41 16.00 10	SD-02 Shop Drawings														
			Shop Drawings	1.5.2													

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		06 41 16.00 10	Shop Drawings	2.12													
			Installation	3.1													
			SD-03 Product Data														
			Wood Materials	2.1													
			Wood Finishes	2.10													
			Finish Schedule	2.12.8.3													
			Certification	1.5.3													
			SD-04 Samples														
			Plastic Laminates	2.3													
			Cabinet Hardware	2.7													
			SD-07 Certificates														
			Quality Assurance	1.5													
			Laminate Clad Casework	2.10													
			Laminate Clad Casework	3.1													
			SD-11 Closeout Submittals														
			LEED Documentation	1.3													
		06 61 16	SD-02 Shop Drawings														
			Detail Fabrication Drawings	1.4.2	G												
			Installation	3.1	G												
			SD-03 Product Data														
			Solid Polymer	2.1.1	G												
			Indoor air quality for solid surface seam and sealant products	2.2.2	S												
			Quartz Agglomerate Material	2.1.1	G												
			SD-04 Samples														
			Material	2.1	G												

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		06 61 16	Counter Tops	2.3.6	G												
			SD-06 Test Reports														
			Test Report Results	2.1.1													
			SD-07 Certificates														
			Qualifications	1.4.1													
			Indoor Air Quality for solid surface fabrication products	2.1.1	S												
			SD-10 Operation and Maintenance Data														
			Solid Polymer	2.1.1	G												
			Quartz Agglomerate Material	2.1.1	G												
		07 11 13	SD-07 Certificates														
			Materials	1.3													
		07 12 00	SD-03 Product Data														
			Manufacturer's Standard Details	1.3	G												
			Protection Board	2.7	G												
			Prefabricated Laminated Asphalt	2.8	G												
			Waterproofing														
			Prefabricated Copper Fabric	2.9	G												
			Membrane Fabric	2.4	G												
			Reinforcing Fabric	3.3.6.2	G												
			SD-06 Test Reports														
			Bulk Liquid Asphalt Certified	1.5.3	G												
			Laboratory Reports														
			SD-07 Certificates														
			Membrane Fabric	2.4	G												



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		07 12 00	Reinforcing Fabric	3.3.6.2	G												
			Protection Board	2.7	G												
			Prefabricated Laminated Asphalt Waterproofing	2.8	G												
			Prefabricated Copper Fabric	2.9	G												
			Certificates of Compliance	2.1.1	G												
			Certificates of Compliance	2.1.2	G												
			SD-08 Manufacturer's Instructions														
			Installation Instructions	3.3.6.1													
			SD-11 Closeout Submittals														
			Asphalt Shipment Records	1.5.3.1													
			Certificates of Compliance	2.1.1	S												
			Certificates of Compliance	2.1.2	S												
			Volatile Organic Compounds (VOC) Contents	2.1.1	S												
			Recycled Content	2.1.2	S												
		07 13 53	SD-03 Product Data														
			Manufacturer's Standard Details	1.3	G												
			Elastomeric Waterproofing Sheet Material	2.2	G												
			Protection Board	2.6	G												
			Primers, Adhesives, and Mastics	1.4	G												
			Primers, Adhesives, and Mastics	2.2	G												
			SD-06 Test Reports														
			Elastomeric Waterproofing Sheet Material	2.2	G												

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		07 13 53	Field Quality Control	3.6	G												
			Protective Covering	3.7	G												
			SD-07 Certificates														
			Elastomeric Waterproofing Sheet Material	2.2													
			Primers, Adhesives, and Mastics	1.4	G												
			Primers, Adhesives, and Mastics	2.2	G												
			Protective Coverings	1.4	G												
			Special Warranties	1.8	G												
			Special Warranties	1.8	G												
			Certificates Of Compliance	2.1.1	G												
			Certificates Of Compliance	2.1.2	G												
			SD-08 Manufacturer's Instructions														
			Primers, Adhesives, and Mastics	1.4	G												
			Primers, Adhesives, and Mastics	2.2	G												
			SD-11 Closeout Submittals														
			Certificates Of Compliance	2.1.1	G												
			Certificates Of Compliance	2.1.2	G												
		07 14 00	SD-03 Product Data														
			Fluid-Applied Membrane	2.1													
			Membrane Primer	2.2													
			Elastomeric Sheet	2.8													
			Flexible Foam-Backed Elastomeric Sheet	2.10													
			Solvent	3.3													
			Moisture Meter	3.4.1													

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		07 14 00	Protection Board	2.11													
			Bond Breaker	2.7													
			SD-11 Closeout Submittals														
			Warranty	1.6													
			Information Card	3.6													
			Instructions To Government	3.5													
			Personnel														
		07 19 00	SD-03 Product Data														
			Water Repellents	2.2													
			SD-06 Test Reports														
			Water Absorption	1.3.2													
			Water Absorption	2.3.1													
			Water Absorption	2.3.2													
			Water Absorption	2.3.3													
			Accelerated Weathering	2.3.1													
			Accelerated Weathering	2.3.2													
			Accelerated Weathering	2.3.3													
			Accelerated Weathering	2.3.4													
			Resistance to Chloride Ion Penetration	2.3.1													
			Resistance to Chloride Ion Penetration	2.3.2													
			Resistance to Chloride Ion Penetration	2.3.3													
			Resistance to Chloride Ion Penetration	2.3.4													

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		07 19 00	Moisture Vapor Transmission	1.3.2													
			Moisture Vapor Transmission	2.3.1													
			Moisture Vapor Transmission	2.3.2													
			Moisture Vapor Transmission	2.3.3													
			Moisture Vapor Transmission	2.3.4													
			Scaling Resistance	2.3.1													
			Scaling Resistance	2.3.2													
			Scaling Resistance	2.3.3													
			Scaling Resistance	2.3.4													
			Water Penetration and Leakage	1.3.2													
			SD-07 Certificates														
			Manufacturer's Qualifications	1.3.1													
			Applicator's Qualifications	1.3.1													
			Evidence of Acceptable Variation	1.3.3													
			Warranty	1.12													
			SD-08 Manufacturer's Instructions														
			Application	3.4													
			Safety Data Sheets	1.7.1													
		07 21 13	SD-03 Product Data														
			Manufacturer's Standard Details	1.3	G												
			Block or Board Insulation	2.1	G												
			Vapor Retarder	2.2	G												
			Pressure Sensitive Tape	2.3	G												
			Protection Board or Coatings	1.4	G												
			Accessories	2.5	G												

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		07 21 13	Recycled Content for Block or Board Insulation	2.1.5	S												
			SD-07 Certificates														
			Block or Board Insulation	2.1	G												
			Vapor Retarder	2.2	G												
			Protection Board or Coating	2.4	G												
			Protection Board or Coating	3.4.5	G												
			Special Warranties	1.8	G												
			Special Warranties	1.8	G												
			Indoor Air Quality For Block Or Board Insulation	2.1.6	S												
			SD-08 Manufacturer's Instructions														
			Block or Board Insulation	2.1													
			Adhesive	2.5.1													
		07 21 16	SD-03 Product Data														
			Blanket Insulation	2.1													
			Recycled Content for Insulation Materials	2.1.2	S												
			Sill Sealer Insulation	2.2													
			Vapor Retarder	2.4													
			Pressure Sensitive Tape	2.5													
			Accessories	2.6													
			SD-07 Certificates														
			Indoor Air Quality for Insulation Materials	2.1.4	S												
			Indoor Air Quality for Adhesives	2.6.1	S												

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		07 21 16	SD-08 Manufacturer's Instructions														
			Insulation	3.3.1													
		07 22 00	SD-02 Shop Drawings														
			Insulation Board Layout	1.3	G												
			Verification of Existing Conditions	1.3	G												
			SD-03 Product Data														
			Insulation	2.1	G												
			Cover Board	1.4	G												
			Fasteners	2.6	G												
			Sheathing Paper	2.4	G												
			Moisture Control	2.5	G												
			Asphalt	1.10.1	G												
			Asphalt	2.3.3	G												
			Recycled Content For Insulation	2.1.3	S												
			SD-06 Test Reports														
			Flame Spread Rating	1.8.1	G												
			SD-07 Certificates														
			Installer Qualifications	1.6	G												
			Certificates Of Compliance For Felt Materials	1.6	G												
			Indoor Air Quality For Insulation	2.1.4	S												
			SD-08 Manufacturer's Instructions														
			Fasteners	2.6	G												
			Insulation	2.1	G												
		07 24 00	SD-02 Shop Drawings														
			Shop Drawings	3.3	G												

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		07 24 00	SD-03 Product Data														
			Sheathing Board	2.2													
			Thermal Insulation	2.6													
			Adhesive	2.3													
			Mechanical Fasteners	2.5													
			Accessories	2.12													
			Base Coat	2.7													
			Portland Cement	2.8													
			Reinforcing Fabric	2.9													
			Finish Coat	2.10													
			Joint Sealant	2.13													
			Sealant Primer	2.11													
			Bond Breaker	2.14													
			Backer Rod	2.15													
			Insulation Board	1.4.5													
			Recycled Content for Insulation Materials	2.6.2	S												
			Warranty	1.7													
			SD-04 Samples														
			Sample Boards	1.2.3.7	G												
			Mock-up Installation of EIFS	1.2.1.4	G												
			SD-05 Design Data														
			Wind Load	1.2.1.2													
			Moisture Analysis	1.2.4													
			SD-06 Test Reports														
			Abrasion Resistance	1.2.3.1													

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		07 24 00	Accelerated Weathering	1.2.3.2													
			Impact Resistance	1.2.2.3													
			Mildew Resistance	1.2.3.3													
			Salt Spray Resistance	1.2.3.4													
			Vapor Transmission	1.2.4													
			Absorption-Freeze-Thaw	1.2.3.6													
			Wall Fire Test	1.2.1.3													
			Water Penetration	1.2.1.1													
			Water Resistance	1.2.3.5													
			Full Scale or Intermediate Scale Fire Test	1.2.1.3													
			Surface Burning Characteristics	1.2.2.1													
			Radiant Heat	1.2.2.2													
			Substrate	3.1													
			Wind Load	1.2.1.2													
			SD-07 Certificates														
			Qualifications of EIFS Manufacturer	1.4.1													
			Qualification of EIFS Installer	1.4.2													
			Qualification of Sealant Applicator	1.4.3													
			Qualifications of Third Party Inspector	1.4.4													
			Inspection Check List	3.5.2	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.3													



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		07 24 00	SD-10 Operation and Maintenance Data														
			EIFS	1.7													
		07 31 13	SD-03 Product Data														
			Shingles	2.1.1													
			Energy Star Label for Asphalt Shingle	2.1.1	S												
			Heat Island Reduction	2.1.1	S												
			SD-04 Samples														
			Shingles	2.1.1	G												
			Color Charts	2.1.1	G												
			SD-08 Manufacturer's Instructions														
			Application	3.3													
			SD-11 Closeout Submittals														
			Manufacturer's Warranty	1.5.1													
			Contractor's Warranty	1.5.2													
		07 41 13	SD-02 Shop Drawings														
			Roofing Panels	1.4.5	G												
			Flashing and Accessories	1.4.5	G												
			Gutter/Downspout Assembly	1.4.5	G												
			SD-03 Product Data														
			Roof Panels	2.1	G												
			Recycled Content for Aluminum Roof Panels	2.1.1	S												
			Recycled Content for Steel Roof Panels	2.1.2	S												

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		07 41 13	Energy Star Label for Metal Roofing Product	2.2.2	S												
			Heat Island Reduction	2.2.2	S												
			Factory-Applied Color Finish	1.4.5	G												
			Accessories	2.4	G												
			Fasteners	1.4.5	G												
			Pressure Sensitive Tape	1.4.5	G												
			Underlayments	2.7	G												
			Gaskets and Sealing/Insulating Compounds	2.8	G												
			Coil Stock	1.4.5	G												
			Aluminized Steel Repair Paint	1.4.5	G												
			Enamel Repair Paint	1.4.5	G												
			Galvanizing Repair Paint	1.4.5	G												
			SD-04 Samples														
			Roof Panels	2.1	G												
			Factory-applied Color Finish	1.4.5	G												
			Accessories	2.4	G												
			Fasteners	1.4.5	G												
			Gaskets and Sealant/Insulating Compounds	1.4.5	G												
			SD-05 Design Data														
			Engineering Calculations	1.4.6	G												
			Wind Uplift Resistance	1.2.1.2	G												
			SD-06 Test Reports														
			Leakage Test Report	1.2.1.1	G												

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		07 41 13	Wind Uplift Test Report	1.2.1.2	G												
			Fire Rating Test Report	2.6.2	G												
			Factory Finish and Color	2.2	G												
			Performance Requirements														
			SD-07 Certificates														
			Roof Panels	2.1	G												
			Coil Stock Compatibility	1.4.5	G												
			Self-Adhering Modified Bitumen	2.7.2	G												
			Underlayment														
			Qualification of Manufacturer	1.4.1	G												
			Qualification of Applicator	1.4.2	G												
			SD-08 Manufacturer's Instructions														
			Insulation	2.6	G												
			Installation Manual	1.4.5	G												
			SD-09 Manufacturer's Field														
			Reports														
			Manufacturer's Field Inspection	3.10.1	G												
			Reports														
			SD-11 Closeout Submittals														
			Warranties	1.8	G												
			Information Card	3.11	G												
			Date Of Installation Wall-Mounted	3.12	G												
			Placard														
		07 41 63	SD-01 Preconstruction Submittals														
			Qualification of Manufacturer	1.4.1	G												
			Qualification of Installer	1.4.1	G												

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		07 41 63	Qualifications for Welding	1.4.1	G												
			Work Plan	1.4.1	G												
			On-Site Inspection and Acceptance Procedure	1.4.1	G												
			SD-02 Shop Drawings														
			Roofing Panels	1.4.1	G												
			Flashing and Accessories	1.4.1	G												
			Gutter/Downspout Assembly	1.4.1	G												
			SD-03 Product Data														
			Sustainable Acquisition	1.4.1	G												
			Coil Stock	1.4.1	G												
			Factory Color Finish	1.4.1	G												
			Sub-girts and Formed Shapes	1.4.1	G												
			Closure Materials	1.4.1	G												
			Insulation	1.4.1	G												
			Pressure-Sensitive Tape	1.4.1	G												
			Sealants and Caulking	1.4.1	G												
			Rated Wall Assembly	1.4.1	G												
			Galvanizing Repair Paint	1.4.1	G												
			Enamel Repair Paint	1.4.1	G												
			Aluminized Steel Repair Paint	1.4.1	G												
			Accessories	1.4.1	G												
			SD-04 Samples														
			Coil Stock	1.4.1	G												
			Roofing Panels	1.4.1	G												
			Fasteners	2.3.1.2	G												

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		07 41 63	Metal Closure Strips	2.5.1	G												
			Insulation	1.4.1	G												
			Manufacturer's Color Charts and Chips	1.4.1	G												
			SD-05 Design Data														
			Wind Design Analysis	1.4.1													
			Seismic Design Analysis	1.4.1													
			SD-06 Test Reports														
			Leakage Tests	3.4.1.2	G												
			Fire Rating Test Report	1.4.1	G												
			Coatings and Base Metals of Metal Roofing	3.1	G												
			Factory Finish and Color Performance Requirements	1.4.1	G												
			Wind Uplift Test Report	1.4.1	G												
			Seismic Test Report	1.4.1	G												
			SD-07 Certificates														
			Coil Stock	1.4.1													
			Fasteners	2.3.1.2													
			Galvanizing Repair Paint	1.4.1													
			Enamel Repair Paint	1.4.1													
			Safety Data Sheets	1.4.1													
			Coating Physical Properties:	2.4.5													
			SD-08 Manufacturer's Instructions														
			Installation of Roof Panel Assemblies	1.4.1													

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		07 41 63	SD-11 Closeout Submittals														
			Warranty	1.7													
			Information Form and Placard	3.3.5	G												
			Manufacturer's Field Inspection Reports	3.4.2													
			Application Instructions	1.4.1													
			Date of Installation Wall-Mounted Placard	3.6.2	G												
			20-year 'No-Dollar-Limit' Warranty for Labor and Materials	1.7.1	G												
		07 42 13	SD-01 Preconstruction Submittals														
			Qualification of Manufacturer	1.5.3	G												
			Qualification of Installation Contractor	1.5.4	G												
			Qualification of Welders	1.5.4.1	G												
			Warranty	1.8	G												
			SD-02 Shop Drawings														
			Installation Drawings	1.5.1.1	G												
			SD-03 Product Data														
			Recycled Content;	2.1													
			Wall Panels	2.2.1	G												
			Wall Panels	2.2.2	G												
			Factory Color Finish	2.2.3													
			Closure Materials	1.5.5													
			Pressure Sensitive Tape	2.5.4.4													
			Sealants and Caulking	2.5.4.1													

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		07 42 13	Galvanizing Repair Paint	1.5.3.1													
			Enamel Repair Paint	1.5.3.1													
			Aluminized Steel Repair Paint	2.7													
			Accessories	1.5.5													
			Accessories	2.5													
			SD-04 Samples														
			Wall Panels	2.2.1	G												
			Wall Panels	2.2.2	G												
			Fasteners	1.5.3.1	G												
			Metal Closure Strips	2.5.3	G												
			Color chart	2.2.3.5	G												
			SD-05 Design Data														
			Wind load design analysis	1.5.1.2	G												
			SD-06 Test Reports														
			Leakage Tests	3.7.2	G												
			Wind Load Tests	1.3.2	G												
			Coating	2.2.3.6	G												
			Chalking	2.2.3.6	G												
			Seismic Tests	1.3.2	G												
			SD-07 Certificates														
			Coil Stock	1.5.3.1	G												
			Fasteners	1.5.3.1	G												
			Galvanizing Repair Paint	1.5.3.1	G												
			Enamel Repair Paint	1.5.3.1	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.3	G												

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		07 42 13	SD-09 Manufacturer's Field Reports														
			Manufacturer's Field Reports	3.8.1	G												
			SD-11 Closeout Submittals														
			Warranty	1.8	G												
			Maintenance Instructions	1.5.6	G												
			20 year 'No Dollar Limit' warranty for labor and material	1.8.1													
		07 42 63	SD-01 Preconstruction Submittals														
			Qualification of Manufacturer	1.5.3													
			Qualification of Installer	1.5.4													
			Qualifications for Welding Work	1.5.4.1													
			SD-02 Shop Drawings														
			Fabrication and Installation drawings	1.5.1													
			Wall Panel Assemblies	1.5.1													
			Flashing and Accessories	1.5.1													
			Anchorage Systems	1.5.1													
			SD-03 Product Data														
			Certification	1.5.10													
			sustainable acquisition	1.5.1													
			Manufacturer's catalog data	1.5.1													
			Factory Color Finish	1.5.1													
			Sub-girts and Formed Shapes	1.5.1													
			Closure Materials	1.5.1													
			Insulation	1.5.1													



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		07 42 63	Pressure Sensitive Tape	1.5.1													
			Sealants and Caulking	2.4.4.1													
			Rated Wall Assembly	1.5.1													
			Galvanizing Repair Paint	1.5.1													
			Enamel Repair Paint	1.5.1													
			Aluminized Steel Repair Paint	1.5.1													
			Accessories	1.5.1													
			SD-04 Samples														
			Wall Panel Assemblies	1.5.1													
			Fasteners	1.5.1													
			Metal Closure Strips	1.5.1													
			Insulation	1.5.1													
			manufacturer's color charts and chips	1.5.1													
			SD-05 Design Data														
			Wind Design Analysis	1.5.1													
			SD-06 Test Reports														
			Leakage Tests	3.7.2													
			Wind Load Tests	1.3.2													
			Seismic Tests	1.3.2													
			Factory Color Finish	1.5.1													
			SD-07 Certificates														
			Fasteners	1.5.1													
			Galvanizing Repair Paint	1.5.1													
			Enamel Repair Paint	1.5.1													

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		07 42 63	wall system assembly wind load and fire rating classification listings	1.5.1													
			SD-08 Manufacturer's Instructions														
			Installation of Wall Panels	1.5.1													
			SD-11 Closeout Submittals														
			Warranty	1.5.1													
			Instructions	1.5.1													
			Safety Data Sheets	1.5.1													
			20 year 'No-Dollar-Limit' Warranty	1.5.1													
		07 51 13	SD-03 Product Data														
			Wind Uplift Calculations	1.4.4	G												
			Asphalt	2.4													
			Felts	3.3.4	G												
			Felts	3.3.4	G												
			Granule Surface Modified	2.5.2	G												
			Bitumen Cap Sheet														
			Heat Island Reduction	2.1.1	S												
			Energy Star Label for Top	2.16	S												
			Coating Product														
			Flashing Membrane	2.3	G												
			Fasteners	2.10													
			Primer	2.6													
			Asphalt Roof Cement	2.7													
			Walkpad Materials	2.12													
			Cant Strips	2.8													

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		07 51 13	Pre-Manufactured Accessories	2.11	G												
			Pre-Manufactured Accessories	2.11	G												
			Roof Walkways	2.12.1													
			Warranties	1.8													
			SD-06 Test Reports														
			Samples of Built-Up Roofing	3.5.3													
			SD-07 Certificates														
			Bill of Lading	1.5.1													
			Qualifications of Applicator	1.4.1													
			SD-08 Manufacturer's Instructions														
			Felts	3.3.4	G												
			Felts	3.3.4	G												
			Flashings	3.5.2	G												
			Modified Bitumen Cap Sheet	3.4.5	G												
			Asphalt	2.4													
			Primer	2.6													
			Roof Cement	3.2.1.2													
			Fasteners	2.10													
			Cold Weather Conditions	1.6	G												
			SD-11 Closeout Submittals														
			Warranty	1.8													
			Information Card	3.7													
		07 52 00	SD-02 Shop Drawings														
			Roof Plan	1.4.8	G												
			Field Inspection and Existing Conditions Report	1.4.8													

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		07 52 00	SD-03 Product Data														
			Modified Bitumen Sheets	2.2	G												
			Heat Island Reduction	2.1.1	S												
			Energy Star Label for Top Coating	2.16	S												
			Asphalt	2.4													
			Cold-Applied Membrane Adhesive	2.5	G												
			Fiberglass Felt	2.2	G												
			Primer	2.7	G												
			Modified Bitumen Roof Cement	2.8	G												
			Pre-Manufactured Accessories	2.11													
			Fasteners And Plates	2.10	G												
			Warranty	1.9	G												
			SD-05 Design Data														
			Wind Uplift Calculations	1.4.7	G												
			SD-07 Certificates														
			Qualification of Manufacturer	1.4.1													
			Qualification of Applicator	1.4.2													
			Qualification of Torch Operator	1.4.3	G												
			Qualification of Engineer of Record	1.4.5													
			Bill of Lading	1.5.1													
			Wind Uplift Resistance	1.4.7	G												
			Fire Resistance	1.4.6	G												
			SD-08 Manufacturer's Instructions														

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		07 52 00	Modified Bitumen Membrane Application	3.3.6	G												
			Flashing	3.3.7	G												
			Temperature Limitations for Asphalt	3.2.3.1													
			Torches	3.2.2.3													
			Cold Adhesive Applied Modified Bitumen Membrane	3.3.3.3	G												
			Primer	2.7													
			Fasteners	2.10.1													
			Ventilating Base Sheets	3.3.4													
			Coating Application	3.3.11.2	G												
			Cold Weather Installation	1.6	G												
			SD-11 Closeout Submittals														
			Warranty	1.9													
			Information Card	3.9													
			Instructions To [Government][Contractor] Personnel	3.8													
		07 53 23	SD-02 Shop Drawings														
			Roof Plan Drawing	1.3.1													
			Wind Load Calculations	1.3.1													
			Boundaries of Enhanced Perimeter	1.3.1													
			Corner Attachments of Roof System Components	1.3.1													

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		07 53 23	Location of Perimeter Half-Sheets	1.3.1													
			Spacing of Perimeter, Corner, and Infield Fasteners	1.3.1													
			Slopes and Drain Locations	1.3.1													
			SD-03 Product Data														
			Cement	2.2													
			EPDM Sheet	2.1.1	G												
			Heat Island Reduction	2.1.2	S												
			Energy Star Label for Top Coating	2.1.15	S												
			Seam Tape	2.1.3													
			Bonding Adhesive	2.1.5													
			Lap Splice Adhesive	2.1.4													
			Water Cutoff Mastic/Water Block	2.1.7													
			Lap Cleaner, Lap Sealant, and Edge Treatment	2.1.6													
			Flashings	3.3													
			Flashing Accessories	2.1.8													
			Flashing Tape	2.1.8.1													
			Fasteners and Plates	2.1.9													
			Ballast	2.1.10													
			Roof Insulation	2.1.14													
			Protection Mat	2.1.11													
			Pre-Manufactured Accessories	2.1.12													
			Warranty	1.8	G												

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		07 53 23	SD-05 Design Data														
			Wind Uplift Calculations	1.4.5	G												
			SD-07 Certificates														
			Qualification of Manufacturer	1.4.1													
			Qualification of Applicator	1.4.2													
			Wind Uplift Resistance	1.4.5	G												
			Fire Resistance	1.4.4	G												
			SD-08 Manufacturer's Instructions														
			Application	3.2	G												
			Application Method	3.2.3	G												
			Membrane Flashing	3.3.2	G												
			Seam Tape	2.1.3													
			Tape Seams / Lap Splices	3.2.4													
			Adhesive Seams / Lap Splices	3.2.5													
			Perimeter Attachment	3.2.6													
			Primer	3.2.4													
			Fasteners	3.2.7													
			Pavers	2.1.10.2													
			Protection Mat	2.1.11													
			Pre-Manufactured Accessories	2.1.12													
			Cold Weather	1.6	G												
			SD-11 Closeout Submittals														
			Warranty	1.8													
			Information Card	3.10													
			Instructions To Government	3.9													
			Personnel														

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		07 60 00	SD-02 Shop Drawings														
			Exposed Sheet Metal	2.2.1	G												
			Gutters	3.1.17	G												
			Downspouts	3.1.18	G												
			Expansion Joints	3.1.26	G												
			Gravel Stops and fascia	2.2.1	G												
			Splash Pans	3.1.22	G												
			Flashing for Roof Drains	3.1.19	G												
			Base Flashing	3.1.11	G												
			Counterflashing	3.1.12	G												
			Flashing at Roof Penetrations and Equipment Supports	3.1.27	G												
			Reglets	2.2.15	G												
			Scuppers	3.1.20	G												
			Copings	3.1.30	G												
			Drip Edges	3.1.16	G												
			Conductor Heads	3.1.21	G												
			Open Valley Flashing	3.1.23	G												
			Eave Flashing	3.1.24	G												
			Recycled Content	2.1	S												
			SD-03 Product Data														
			Cool Roof	2.2.12	G												
			SD-04 Samples														
			Finish Samples	1.4.2	G												
			SD-08 Manufacturer's Instructions														
			Instructions for Installation	1.4.3	G												



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		07 60 00	Quality Control Plan	3.5	G												
			SD-10 Operation and Maintenance Data														
			Cleaning and Maintenance	1.4.3	G												
		07 61 14.00 20	SD-02 Shop Drawings														
			Roofing	1.2.5	G												
			SD-03 Product Data														
			Roofing Panels	2.1	G												
			Energy Star Label for Steel Roofing Product	2.1	S												
			Recycled Content for Steel Roofing Product	2.1.1	S												
			Heat Island Reduction	2.1	S												
			Attachment Clips	2.3													
			Closures	2.4.1													
			Accessories	2.4													
			Fasteners	2.4.2													
			Sealants	2.4.3													
			Insulation	2.5													
			Warranty	1.7	G												
			SD-04 Samples														
			Panel	2.1													
			Accessories	2.4													
			Sealants	2.4.3													
			Intermediate Support	2.2													
			SD-05 Design Data														

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		07 61 14.00 20	Design Calculations	1.5													
			SD-06 Test Reports														
			Field Inspection	3.6													
			Structural Performance	1.3.3													
			Finish	1.6.6													
			SD-07 Certificates														
			Manufacturer's Technical Representative	1.6.3													
			Installer's Qualifications	1.6.4													
			Coil Stock	2.1	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.3	G												
			SD-11 Closeout Submittals														
			Information Card	3.8													
			Warranty	1.7													
		07 72 20	SD-02 Shop Drawings														
			Roof Ventilators	3.1	G												
		07 81 00	SD-03 Product Data														
			Fireproofing Material	3.3	G [NVF]												
			SD-04 Samples														
			Spray-Applied Fireproofing	2.1	G [NVF]												
			SD-06 Test Reports														
			Fire Resistance Rating	1.2.2	G [NVF]												
			Field Tests	3.6	G												
			Evaluation Reports	1.2.3	G												
			SD-07 Certificates														

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		07 81 00	Installer Qualifications	1.4.1	G												
			Surface Preparation Report	3.1	G [NVF												
			Manufacturer's Inspection Report	3.5.2	G [NVF												
		07 84 00	SD-02 Shop Drawings														
			Firestopping System	2.1	G												
			SD-03 Product Data														
			Firestopping Materials	2.2	G												
			SD-06 Test Reports														
			Inspection	3.3	G												
			SD-07 Certificates														
			Inspector Qualifications	1.5.2													
			Firestopping Materials	2.2													
			Installer Qualifications	1.5.1	G												
		07 92 00	SD-03 Product Data														
			Sealants	2.1	G												
			Primers	2.2	G												
			Bond Breakers	2.3	G												
			Backstops	2.4	G												
			Field Adhesion	3.1	G												
			SD-07 Certificates														
			Indoor Air Quality For Interior	2.1.1	S												
			Sealants														
			Indoor Air Quality For Interior	2.1.3	S												
			Floor Joint Sealants														
			Indoor Air Quality For Interior	2.1.4	S												
			Acoustical Sealants														

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		07 92 00	Indoor Air Quality For Interior Caulking	2.5	S												
		08 01 52	SD-02 Shop Drawings														
			Shop Drawings	1.5	G												
			SD-03 Product Data														
			Hardware	2.4													
			Weatherstripping	3.2.10													
			Qualifications	1.5													
			SD-04 Samples														
			Hardware	2.4													
			Moldings	3.2.10													
			Weatherstripping	3.2.10													
			SD-11 Closeout Submittals														
			LEED Documentation	1.3													
		08 11 13	SD-02 Shop Drawings														
			Doors	2.1	G												
			Doors	2.1	G												
			Frames	2.6	G												
			Frames	2.6	G												
			Accessories	2.4													
			SD-03 Product Data														
			Doors	2.1	G												
			Recycled Content for Steel Door Product	2.1	S												
			Frames	2.6	G												

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		08 11 13	Recycled Content for Steel Frame Product	2.6	S												
			Accessories	2.4													
			SD-04 Samples														
			Factory-applied Enamel Finish	2.10.4	G												
		08 11 16	SD-02 Shop Drawings														
			Door and Frame Assembly	1.5.1	G												
			SD-03 Product Data														
			Door and Frame Assembly	1.5.1	G												
			Recycled Content of Aluminum Material	2.2.3	S												
			SD-04 Samples														
			Finish Samples	1.5.2	G												
			SD-05 Design Data														
			Design Analysis	1.5.3	G												
			Calculations	1.2.1	G												
			Air Infiltration	1.2.3	G												
			Water Penetration	1.2.4	G												
			Standard Airblast	1.2.1.1	G												
			NFRC Project Label Certificates for Fenestration	1.2.5	G												
			SD-08 Manufacturer's Instructions														
			Door and Frame Assembly	1.5.1	G												
			Adjustments, Cleaning, and Maintenance	1.5.5	G												

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																		(g)
		08 11 16	NFRC Project Label Certificates for Fenestration	1.2.5	G													
		08 11 69	SD-02 Shop Drawings															
			Storm doors	2.1.4														
			SD-03 Product Data															
			Storm doors	2.1.4														
			Hardware	2.1.4.1														
			SD-04 Samples															
			Storm doors	2.1.4														
			finishes	2.3	G													
			SD-06 Test Reports															
			Storm doors	2.1.4														
			SD-10 Operation and Maintenance Data															
			Storm doors	2.1.4	G													
		08 11 73	SD-02 Shop Drawings															
			Sliding Fire Doors	2.1	G													
			SD-03 Product Data															
			Sliding Fire Doors	2.1	G													
			Electrical Work	2.3.3	G													
			SD-08 Manufacturer's Instructions															
			Sliding Fire Doors	2.1														
			SD-10 Operation and Maintenance Data															
			Sliding Fire Doors	2.1	G													
		08 13 73	SD-02 Shop Drawings															

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		08 13 73	Sliding Metal Doors	1.7													
			SD-07 Certificates														
			Fire Doors	1.2													
			Fabrication Drawings	1.4													
			Installation Drawings	1.4													
			Design Analysis and Calculations	1.2.1													
			Sliding Door Assemblies	1.2.1													
			Hardware and Accessories	1.2.1													
			Doors	2.1													
			Flush Doors	2.2													
			Rails	2.6													
			Paint	2.11													
		08 14 00	SD-02 Shop Drawings														
			Doors	2.1	G												
			SD-03 Product Data														
			Doors	2.1	G												
			Recycled Content for Door Cores	2.1.2.2	S												
			Accessories	2.2													
			Water-resistant Sealer	2.3.7													
			Warranty	1.5													
			Sound Transmission Class	2.1.6	G												
			Rating														
			Fire Resistance Rating	2.1.7	G												
			SD-04 Samples														
			Doors	2.1													
			Door Finish Colors	2.3.6.4	G												

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		08 14 00	SD-06 Test Reports														
			Cycle-Slam	2.4													
			Hinge Loading Resistance	2.4													
			SD-07 Certificates														
			Certificates of Grade	1.3.1													
			Certified Sustainably Harvested Stile and Rail Wood Doors	2.1.1	S												
			Certified Sustainably Harvested Flush Wood Doors	2.1.2	S												
			Indoor Air Quality for Particleboard and Agrifiber Door Cores	2.1.2.2	S												
			SD-11 Closeout Submittals														
			Warranty	1.5													
		08 22 20	SD-02 Shop Drawings														
			Doors	2.1.1.5	G												
			Frames	2.1.1.5	G												
			Door Hardware Components and Accessories	2.1.1.10	G												
			Weather-stripping	2.1.1.10	G												
			Smoke Seals	2.1.1.10	G												
			SD-03 Product Data														
			Doors	2.1.1.5	G												
			Calculations	2.1.2.1	G												
			Frames	2.1.1.5	G												



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		08 22 20	Door Hardware Components and Accessories	2.1.1.10	G												
			Weather-stripping	2.1.1.10	G												
			Smoke Seals	2.1.1.10	G												
			Thresholds	2.1.1.10	G												
			Fire Resistance Rating for Doors and Frames	2.1.1.5	G												
			SD-04 Samples														
			Product Samples	1.4.1	G												
			SD-07 Certificates														
			Sample Warranty	1.2.1	G												
			Warranty	3.4.1	G												
		08 31 00	SD-02 Shop Drawings														
			Access Doors And Panels	1.3	G												
			SD-03 Product Data														
			Access Doors And Panels	1.3	G												
			Hardware	1.3.2	G												
			Accessories	2.2.8	G												
			Power Transfer Components	1.3.1	G												
			Recycled Content	2.1	S												
			SD-04 Samples														
			Finishes	2.5	G												
			SD-06 Test Reports														
			Fire-rating(s) of Assemblies	1.3.1	G												
			Acoustical Ratings of Assemblies	1.3.1	G												
		08 32 13	SD-02 Shop Drawings														

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																		(a)
		08 32 13	Aluminum Sliding Glass Doors	2.1														
			SD-03 Product Data															
			Aluminum Sliding Glass Doors	2.1														
			Hardware	2.1.1														
			Glazing	2.1.2														
			Weatherstripping	2.1.3														
			Screens	2.1.4														
			Finish	2.1.5														
			SD-04 Samples															
			Finish	2.1.5														
			SD-10 Operation and Maintenance															
			Data															
			Aluminum Sliding Glass Doors	2.1	G													
		08 33 13	SD-02 Shop Drawings															
			Detail Drawings	1.3	G													
			SD-03 Product Data															
			Warranty	1.5														
			Rolling Counter Doors	2.1														
			Installation	3.1														
			Cleaning	3.5														
			SD-06 Test Reports															
			Drop-test	3.3														
			SD-11 Closeout Submittals															
			Rolling Counter Door	2.3														
			(Non-Rated)															
			Fire-Rated Rolling Counter Door	2.4														

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		08 33 23	SD-02 Shop Drawings														
			Overhead Coiling Doors	2.2.1	G												
			Counterbalancing Mechanism	2.2.3	G												
			Manual Door Operators	2.2.4	G												
			Electric Door Operators	2.2.5	G												
			Bottom Bars	2.2.1.4	G												
			Guides	2.1.1.1	G												
			Mounting Brackets	2.2.3.1	G												
			Hood	2.2.2.2	G												
			Installation Drawings	2.1.1.1	G												
			SD-03 Product Data														
			Overhead Coiling Doors	2.2.1	G												
			Hardware	2.2.2	G												
			Counterbalancing Mechanism	2.2.3	G												
			Manual Door Operators	2.2.4	G												
			Electric Door Operators	2.2.5	G												
			Fire-Rated Door Assembly	2.2.6	G												
			Recycled content for steel curtain slats	2.2.1.1	S												
			Recycled content for stainless steel curtain slats	2.2.1.1	S												
			SD-05 Design Data														
			Overhead Coiling Doors	2.2.1	G												
			Hardware	2.2.2	G												
			Counterbalancing Mechanism	2.2.3	G												
			Manual Door Operators	2.2.4	G												

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		08 33 23	Electric Door Operators	2.2.5	G												
			Fire-Rated Door	1.3	G												
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	1.3.2	G												
			SD-11 Closeout Submittals Warranty	1.3.1	G												
		08 34 01	SD-02 Shop Drawings Installation	3.5	G												
			SD-03 Product Data Forced Entry Resistant Components	1.3													
			Installation Components	3.5													
			Components	1.4													
			SD-07 Certificates Forced Entry Resistant Components	1.3	G												
		08 34 02	SD-02 Shop Drawings Installation	3.3	G												
			SD-03 Product Data Bullet Resistant Components	1.4													
			Bifold Doors	2.5.2													
			SD-07 Certificates Bullet Resistant Components	1.4													

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		08 34 02	SD-10 Operation and Maintenance Data														
			Bullet Resistant Components	1.4	G												
		08 34 16	SD-01 Preconstruction Submittals														
			Manufacturer's Qualifications	1.4.1	G												
			Installer's Qualifications	1.4.2	G												
			SD-02 Shop Drawings														
			Door Materials	1.3.1	G												
			SD-05 Design Data														
			Door Structure	1.3.2	G												
			SD-10 Operation and Maintenance Data														
			Lubrication	1.3.3	G												
			Air System	1.3.3	G												
			Electrical Equipment	1.3.3	G												
		08 34 58	SD-02 Shop Drawings														
			Vault Door Unit	2.1													
			Doors	2.2													
			Day Gate	2.4													
			Frames and Sills	2.3													
			Hardware	2.2													
			SD-03 Product Data														
			Vault Door Unit	2.1													
			Doors	2.2													
			Day Gate	2.4													
			Frames and Sills	2.3													

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		08 34 58	SD-07 Certificates														
			Vault Door Unit	2.1													
			Frames and Sills	2.3													
			Hardware	2.2													
		08 34 59	SD-02 Shop Drawings														
			Vault Door Unit	2.1	G												
			Day Gate	2.3	G												
			SD-03 Product Data														
			Vault Door and Frame	2.2													
			SD-07 Certificates														
			Vault Door and Frame	2.2													
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-11 Closeout Submittals														
			LEED Documentation	1.2													
		08 34 63	SD-02 Shop Drawings														
			doors and frames	2.2													
			SD-03 Product Data														
			doors and frames	2.2													
			SD-06 Test Reports														
			Door fabrication	2.2.1													
		08 34 73	SD-02 Shop Drawings														
			Fabrication Drawings	2.1													
			SD-03 Product Data														
			Hollow Metal Sound Retardant	2.1	G												
			Doors														

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		08 34 73	Wood Sound Retardant Doors	2.1	G												
			Door Frames	2.1	G												
			Door Hardware	2.1	G												
			Door Frame Sound Infill	2.3.2	G												
			Vision Panels	2.1	G												
			Intumescent Seals and Gasketing	2.1	G												
			Thresholds	2.1	G												
			Astragals	2.1	G												
			SD-06 Test Reports														
			Wind Loading Tests	2.4.4	G												
			Water Leakage Tests	2.4.4	G												
			Acoustical Tests	2.4.4	G												
			Air Infiltration Tests	2.4.4	G												
			Positive Pressure Tests	2.4.4	G												
			SD-07 Certificates														
			Hollow Metal Sound Retardant Doors	2.1	G												
			Wood Sound Retardant Doors	2.1	G												
			Door Frames	2.1	G												
			Door Hardware	2.1	G												
			Vision Panels	2.1	G												
			Intumescent Seals,Gasketing [and Door Bottoms]	1.3.1.3	G												
			Thresholds	2.1	G												
			Astragals	2.1	G												
			Assembly Test Reports	3.3.1													

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		08 36 13	SD-02 Shop Drawings														
			Doors	2.2	G												
			SD-03 Product Data														
			Doors	2.2	G												
			Electric Operators	2.6	G												
			SD-08 Manufacturer's Instructions														
			Doors	2.2													
			SD-10 Operation and Maintenance														
			Data														
			Doors	2.2	G												
		08 36 19	SD-02 Shop Drawings														
			Doors	2.2	G												
			SD-03 Product Data														
			Doors	2.2	G												
			Motors	2.4.1	G												
			Controls	2.4.2	G												
			SD-08 Manufacturer's Instructions														
			Doors	2.2													
			SD-10 Operation and Maintenance														
			Data														
			Doors	2.2	G												
		08 39 53	SD-02 Shop Drawings														
			Blast Resistant Door	1.2	G												
			Trolley Track	2.2.1.2	G												
			Trolleys	2.2.1	G												
			SD-03 Product Data														



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		08 39 53	Trolleys	2.2.1	G												
			SD-05 Design Data														
			Manual Operator	2.2.1.1	G												
			SD-10 Operation and Maintenance														
			Data														
			Blast Resistant Door	1.2	G												
		08 39 54	SD-02 Shop Drawings														
			Installation	3.1	G												
			SD-03 Product Data														
			Door Description	1.2	G												
			Design Requirements	1.2.1	G												
			Manufacturer's Field Service	3.3													
			SD-06 Test Reports														
			Tests	3.2													
			Tests, Inspections, and Verifications	2.6													
			Fire Rating Test and Inspection	2.6.6													
			Prototype Static Test	2.6.1	G												
			Prototype Blast Test	2.6.2	G												
			SD-07 Certificates														
			Materials	2.1													
			Fire-Rated Door Assemblies	2.6.6													
			Thermal Insulation	2.4.3													
			Sound Rating Test	2.6.5													
			SD-10 Operation and Maintenance														
			Data														

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		08 39 54	Door Description	1.2	G												
		08 41 13	SD-01 Preconstruction Submittals														
			Sample Warranty	1.2.1	G												
			List of Product Installations	1.2.1	G												
			SD-02 Shop Drawings														
			Installation Drawings	3.3	G												
			Fabrication Drawings	2.2	G												
			SD-03 Product Data														
			Manufacturer's Catalog Data	1.2.1	G												
			Finish	2.2.3	G												
			Recycled Content of Aluminum Material	2.1.1.2	S												
			SD-04 Samples														
			Finish and Color Samples	1.2.1	G												
			SD-06 Test Reports														
			Certified Test Reports	1.2.1	G												
			Deflection	3.4.3													
			Air Infiltration	3.4.1													
			Condensation Resistance and Thermal Transmittance	3.4.4													
			Water Infiltration	3.4.5													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	3.3													
			SD-11 Closeout Submittals														
			Manufacturer's Product Warranty	3.6													
		08 44 00	SD-02 Shop Drawings														

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		08 44 00	Glazed Curtain Wall System	1.5	G												
			Installation Drawings	1.5													
			Shop-Painting Aluminum	2.4.2	G												
			Shop-Painting Steel	2.4.3	G												
			SD-03 Product Data														
			Glazed Curtain Wall System	1.5	G												
			Metals For Fabrication	2.2	G												
			Nonskinning Sealing Compound	2.3	G												
			Metal Accessories	2.4.1	G												
			Curtain-Wall Framing Members	2.5	G												
			Aluminum Doors and Frames	2.6	G												
			Laminated Panels	2.1.15.2	G												
			Thermal Insulation Materials	2.9	G												
			Masonry Anchorage Devices	2.11.4	G												
			Recycled Content of Aluminum	2.1.1	S												
			Doors and Frames														
			Recycled Content of Aluminum	2.1.1	S												
			Curtain-Wall Framing Members														
			Recycled Content of Aluminum	2.1.1	S												
			Windows														
			Warranties	1.7.1	G												
			SD-05 Design Data														
			Anodic Finish	2.4.5	G												
			Pigmented Organic Coating	2.4.6	G												
			Exposed-to-View Aluminum	2.4.5	G												
			Finish														

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		08 44 00	Seismic Calculations	1.5.5	G												
			Structural Calculations for Deflection	1.3.6.1	G												
			Design Analysis	1.9.1.1	G												
			SD-06 Test Reports														
			Factory Test Results	1.3.6	G												
			Standard Airblast Test	1.9.1.3	G												
			Field Water Spray Test Results	1.4.1	G												
			Air Infiltration Test Results	1.4.2	G												
			Water Penetration Test Results	1.4.2.1	G												
			SD-07 Certificates														
			Energy Performance Certificates	1.3.6.6	G												
			Engineer Qualifications	1.3.1	G												
			Qualifications for the Curtain-Wall Installer	1.3.3	G												
			SD-08 Manufacturer's Instructions														
			Glazed Curtain Wall System	1.5	G												
			Insulating Glass	3.3.13	G												
			Preventive Maintenance and Inspection	3.6.2	G												
			SD-11 Closeout Submittals														
			Warranty	1.7	G												
		08 51 13	SD-02 Shop Drawings														
			Windows	2.1	G												
			Fabrication Drawings	1.7													
			SD-03 Product Data														

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		08 51 13	Windows	2.1	G												
			Recycled Content of Aluminum	2.1	S												
			Windows														
			Hardware	2.2.7.1	G												
			Fasteners	2.2.2	G												
			Window Performance	1.8	G												
			Thermal-Barrier Windows	2.4	G												
			Mullions	2.5	G												
			Window Cleaners' Bolts	2.6	G												
			Screens	2.2.9	G												
			Weatherstripping	2.1.12	G												
			Accessories	2.2.7	G												
			Adhesives	2.2.3													
			Thermal Performance	1.8.5	G												
			Energy Star Label For	1.8.5	S												
			Residential Aluminum Window														
			Products														
			SD-04 Samples														
			Finish Sample	1.3.4.1													
			Window Sample	1.3.4.2													
			Mock-Ups	1.3.4.3	G												
			SD-05 Design Data														
			Structural Calculations for	2.1	G												
			Deflection														
			Design Analysis	1.3.5	G												
			SD-06 Test Reports														

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		08 51 13	Minimum Condensation Resistance Factor	1.3.6													
			Resistance to Forced Entry	1.3.6													
			Standard Airblast Test	1.8.2.3	G												
			Windborne-Debris-Impact Performance	1.8.8													
			SD-07 Certificates														
			Engineer's Qualifications	1.3.3													
			SD-10 Operation and Maintenance Data														
			Windows	2.1	G												
			Plastic Identification	1.5													
		08 51 23	SD-02 Shop Drawings														
			Windows	2.2													
			SD-03 Product Data														
			Steel Framing Materials	2.1.1													
			Recycled Content for Steel Framing Materials	2.1.1	S												
			Mullions	2.5													
			Hardware	2.7.3													
			Hardware Materials	2.7.3.1													
			Fasteners	2.7.4													
			Accessories	2.7													
			Operators	2.10.1.1													
			Screens	2.11													
			SD-04 Samples														

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		08 51 23	Color Coating	2.9.2	G												
			Windows	2.2													
			SD-05 Design Data														
			Structural Calculations for Deflection	1.3.5	G												
			Design Analysis	1.3.5	G												
			SD-06 Test Reports														
			Air Infiltration	1.4.1													
			Water Infiltration	1.4.1													
			Mullion and Transom Bar Wind Load	1.4.2													
			Minimum Condensation Resistance Factor	1.4.3													
			Resistance to Forced Entry	1.4.3													
			Standard Airblast Test	1.4.3	G												
			Windborne-Debris-Impact Performance	1.5.3													
			SD-07 Certificates														
			Engineer's Qualifications	1.3.4													
			SD-10 Operation and Maintenance Data														
			Windows	2.2	G												
		08 52 00	SD-02 Shop Drawings														
			Wood Windows	2.2	G												
			SD-03 Product Data														
			Wood Windows	2.2	G												

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		08 52 00	Energy Star Label for Residential Windows	1.5.1	S												
			Engineered Wood Products	1.2.3													
			Fasteners	2.3.2													
			Adhesives	2.3.1	G												
			SD-08 Manufacturer's Instructions														
			Wood Windows	2.2													
			SD-10 Operation and Maintenance Data														
			Wood Windows	2.2	G												
			Plastic Identification	1.4.1													
		08 53 00	SD-02 Shop Drawings														
			Windows	2.2.1	G												
			Windows	2.2.1	G												
			SD-03 Product Data														
			Windows	2.2.1	G												
			Energy Star Label for Residential Windows	1.7.1	S												
			Fasteners	2.4.8													
			Hardware	2.4.4													
			Screens	2.4.6													
			Weatherstripping	2.4.5													
			Accessories	2.4.9													
			Adhesives	2.2.4													
			SD-04 Samples														
			Windows	2.2.1	G												



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		08 53 00	SD-06 Test Reports														
			Windows	2.2.1	G												
			SD-10 Operation and Maintenance														
			Data														
			Windows	2.2.1	G												
			Plastic Identification	1.6.1													
		08 56 53	SD-02 Shop Drawings														
			Windows	1.3.2	G												
			Fabrication Drawings	1.7													
			SD-03 Product Data														
			Window Units	2.1	G												
			Hardware	2.5.8													
			Setting Materials	2.4													
			Weatherstripping	2.2													
			SD-04 Samples														
			Finish Sample	1.3.4.1													
			Window Sample	1.3.4.2													
			Window Mock-Ups	1.3.4.3	G												
			SD-05 Design Data														
			Structural Calculations for	1.3.5	G												
			Deflection														
			Design Analysis	1.3.5	G												
			SD-06 Test Reports														
			Minimum Condensation	1.3.6													
			Resistance Factor														
			Resistance to Forced Entry	1.3.6													

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		08 56 53	Standard Airblast Test	1.3.6	G												
			Windborne-Debris-Impact Performance	1.8.6													
			SD-07 Certificates														
			Engineer's Qualifications	1.3.3													
			SD-08 Manufacturer's Instructions														
			Glass	2.3													
			SD-10 Operation and Maintenance Data														
			Window Units	2.1	G												
		08 56 63	SD-02 Shop Drawings														
			Window Units	2.2													
			SD-03 Product Data														
			Window Units	2.2													
			Fasteners	2.3.3													
			Accessories	2.6													
			SD-06 Test Reports														
			Air Infiltration	1.3.1.1													
			Water infiltration	1.3.1.1													
			Mullion and Transom Bar Wind Load	1.3.1.2													
		08 60 45	SD-02 Shop Drawings														
			Shop Drawings	3.2	G												
			SD-03 Product Data														
			[Skylights] and [Translucent Panels]	2.1	G												

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		08 60 45	Recycled Content for Aluminum Framing Materials	2.2.4	S												
			Energy Star Label for Residential Skylights	2.4.3	S												
			Warranty	1.6													
			SD-06 Test Reports														
			Test Reports	2.1													
			SD-07 Certificates														
			Systems	2.5													
			Qualifications	1.4													
		08 71 00	SD-02 Shop Drawings														
			Manufacturer's Detail Drawings	1.3	G												
			Verification of Existing Conditions	1.3	G												
			Hardware Schedule	1.5	G												
			Keying System	2.3.11	G												
			SD-03 Product Data														
			Hardware Items	2.3	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Hardware Schedule	1.5	G												
			SD-11 Closeout Submittals														
			Key Bitting	1.6.1													
		08 71 63	SD-01 Preconstruction Submittals														
			Detention hardware schedule	1.3.3													

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		08 71 63	SD-02 Shop Drawings														
			Type 1 lock	2.5.1													
			Type 3 lock	2.5.3													
			Door position switches	2.10													
			Detention hinges	2.4													
			SD-03 Product Data														
			Keys and cylinders	2.2													
			Detention hinges	2.4													
			Detention locks	2.5													
			Door trim	2.8													
			Door position switches	2.10													
			Security door accessories	2.11													
			SD-10 Operation and Maintenance														
			Data														
			Detention locks	2.5	G												
			DOOR CLOSERS	2.6	G												
			Door position switches	2.10	G												
		08 81 00	SD-03 Product Data														
			Insulating Glass	2.3													
			Plastic Glazing	2.4													
			Glazing Accessories	1.3													
			Sealants	2.5.3.1													
			Joint Backer	2.5.4													
			SD-04 Samples														
			Insulating Glass	2.3													
			Plastic Sheet	3.2.7													

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		08 81 00	Glazing Compound	2.5.2													
			Tape	2.5.6													
			Sealing Tapes	2.5.6													
			SD-07 Certificates														
			Insulating Glass	2.3													
			Plastic Glazing	2.4													
			SD-08 Manufacturer's Instructions														
			Setting and Sealing Materials	2.5													
			Glass Setting	3.2													
			SD-11 Closeout Submittals														
			Insulated Glass Units	1.7.1													
			Warranty for Polycarbonate Sheet	1.7.2													
			Monolithic Reflective Glass	1.7.3													
			Monolithic Opacified Spandrel	1.7.4													
			Energy Efficient Equipment for Residential Windows	2.1.1	S												
		08 88 53	SD-03 Product Data														
			Glazing materials	2.2													
			SD-04 Samples														
			Glazing materials	2.2													
			SD-08 Manufacturer's Instructions														
			Glass setting	3.3													
		08 88 58	SD-02 Shop Drawings														
			Tower Cab Glass	2.2	G												
			SD-03 Product Data														

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		08 88 58	Laminated Annealed Glass	2.3.1	G												
			Low-E Coated Laminated Annealed Glass	2.3.2	G												
			Insulated Laminated Annealed Glass Units	2.3.3	G												
			Low-E Coated Insulated Laminated Annealed Glass Units	2.3.4	G												
			Setting and Sealing Materials	1.6.8	G												
			Setting and Sealing Materials	2.4	G												
			Glazing Accessories	1.6.7	G												
			Glazing Accessories	2.4.6	G												
			SD-04 Samples														
			Laminated Annealed Glass	2.3.1	G												
			Low-E Coated Laminated Annealed Glass	2.3.2	G												
			Insulated Laminated Annealed Glass Units	2.3.3	G												
			Low-E Coated Insulated Laminated Annealed Glass Units	2.3.4	G												
			Setting and Sealing Materials	1.6.8	G												
			Setting and Sealing Materials	2.4	G												
			Glazing Accessories	1.6.7	G												
			Glazing Accessories	2.4.6	G												
			SD-05 Design Data														
			Cab Glazing Design Analysis	2.1.1	G												
			Glass Wind Load Calculations	2.1.2	G												

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		08 88 58	SD-06 Test Reports														
			Compatibility and Adhesion Test Reports	1.6.7													
			Compatibility and Adhesion Test Reports	1.6.8													
			Standard Airblast Test	2.1.4													
			SD-07 Certificates														
			Glass Engineer Qualifications	1.6.1													
			Fabricator Qualifications	1.6.2													
			Insulating Glass Certification	1.6.3													
			Installer Qualifications	1.6.4													
			Product Certificates	1.6.6													
			Local/Regional Materials	1.9.1													
			Environmental Data	1.9.3													
			SD-10 Operation and Maintenance Data														
			Maintenance Manuals	3.7													
			Warranty for Insulating Glass Products	1.10.1													
			Warranty for Laminated Glass Products	1.10.2													
			Warranty for Coated-Glass Products	1.10.3													
		08 91 00	SD-02 Shop Drawings														
			Wall Louvers	1.4													
			SD-03 Product Data														

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		08 91 00	Metal Wall Louvers	2.2													
			Door Louvers	2.3													
			SD-04 Samples														
			Wall Louver Samples	1.5	G												
			Door Louver Samples	1.5	G												
		09 22 00	SD-02 Shop Drawings														
			Metal Support Systems	2.1	G												
			SD-03 Product Data														
			Metal Support Systems	2.1													
			Recycled Content for Metal Support Systems	2.1	S												
		09 23 82	SD-02 Shop Drawings														
			Installation Drawings	1.5.3	G												
			SD-03 Product Data														
			Manufacturer's Catalog Data	1.5.1	G												
			SD-04 Samples														
			Fireproofing Plaster Sample	1.5.2	G												
			Mockups	1.5.5	G												
			SD-07 Certificates														
			Certificates of Conformance	1.5.4	G												
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	1.5.4	G												
			Special Provisions	1.5.4	G												
		09 24 23	SD-02 Shop Drawings														
			Lath	3.4													
			SD-03 Product Data														



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		09 24 23	Proportions and Mixing	3.7													
			Recycled percentage of fly ash in Portland cement	2.1	S												
			Recycled Content for steel framing	2.6	S												
			Recycled Content for metal lath	2.7	S												
			SD-04 Samples														
			Colored Stucco Finish Coat	2.2													
			Sample Panel	1.3	G												
		09 26 00	SD-03 Product Data														
			Gypsum Base	2.1.4													
			Gypsum Veneer Plaster	2.1.5													
			Recycled Content for Steel Framing or Furring	2.1.1	S												
		09 29 00	SD-03 Product Data														
			Cementitious Backer Units	2.1.9													
			Glass Mat Water-Resistant Gypsum Tile Backing Board	2.1.4													
			Water-Resistant Gypsum Backing Board	2.1.3													
			Glass Mat Covered or Reinforced Gypsum Sheathing	2.1.5													
			Glass Mat Covered or Reinforced Gypsum Sheathing Sealant	2.1.5.1													
			Abuse Resistant Gypsum Board	2.1.6													
			Accessories	2.1.15													

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		09 29 00	Gypsum Board	2.1.1													
			Recycled Content for Gypsum Board	2.1.1	S												
			Recycled Content for Paper Facing and Gypsum Cores	2.1.1	S												
			VOC Content of Joint Compound	2.1.10	S												
			SD-04 Samples														
			Predecorated Gypsum Board	2.1.8	G												
			SD-06 Test Reports														
			ASTM E90 Factory Test Report	2.1.7.1	G												
			ASTM E90 Factory Test Report	3.7	G												
			ASTM E90 Factory Test Report	3.10	G												
			ASTM E336 Field Test Report	3.10	G												
			SD-07 Certificates														
			Asbestos Free Materials	2.1	G												
			Indoor Air Quality for Gypsum Board	2.1.1	S												
			Indoor Air Quality for Non-aerosol Adhesives	2.1.12	S												
			Indoor Air Quality for Aerosol Adhesives	2.1.12	S												
			SD-08 Manufacturer's Instructions														
			Safety Data Sheets	2.1													
			SD-10 Operation and Maintenance Data														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH
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		09 29 00	Manufacturer Maintenance Instructions	2.1													
		09 30 10	SD-02 Shop Drawings														
			Detail Drawings	3.2	G												
			SD-03 Product Data														
			Porcelain Tile	2.1.1	G												
			Recycled Content for Porcelain Tile	2.1.1	S												
			Gauged [Porcelain Tile] and ][Porcelain Tile Panels/Slabs]	2.1.2	G												
			Quarry Tile	2.1.3	G												
			Recycled Content for Quarry Tile	2.1.3	S												
			Mosaic Tile	2.1.4	G												
			Recycled Content for Mosaic Tile	2.1.4	S												
			Large Format Glass Tile	2.1.5	G												
			Recycled Content for Glass Tile	2.1.5	S												
			Glazed Ceramic Wall Tile	2.1.6	G												
			Recycled Content for Glazed Ceramic Wall Tile	2.1.6	S												
			Transition Strips	2.1	G												
			Transition Strips	2.6.1	G												
			Metal Strips	2.6.2	G												
			Setting-Bed	2.2	G												
			Mortar, Grout, and Adhesive	2.4	G												
			Reinforcing Wire Fabric	2.2.6													
			Cementitious Backer Units	2.5.1	G												

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		09 30 10	Glass-Mat Gypsum	2.5.2	G												
			Water-Resistant Backing Board														
			Waterproof Membrane	2.7	G												
			Crack Isolation Membrane	2.8	G												
			SD-04 Samples														
			Tile	2.1	G												
			Accessories	2.1	G												
			Accessories	2.1.7	G												
			Transition Strips	2.1	G												
			Transition Strips	2.6.1	G												
			Metal Strips	2.6.2	G												
			Grout	2.4.4	G												
			SD-07 Certificates														
			Indoor Air Quality for Adhesives	2.4	S												
			Indoor Air Quality for Sealants	2.4.9	S												
			Water Absorption Rates	1.3.2													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Approved	3.8													
			Cleaning Instructions														
			SD-10 Operation and Maintenance														
			Data														
			Gauged [Porcelain Tile] and	2.1.2	G												
			][Porcelain Tile Panels/Slabs]														
			Porcelain Tile	2.1.1	G												
			Quarry Tile	2.1.3	G												
			Mosaic Tile	2.1.4	G												

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		09 30 10	Large Format Glass Tile	2.1.5	G												
			Glazed Ceramic Wall Tile	2.1.6	G												
			Transition Strips	2.1	G												
			Transition Strips	2.6.1	G												
			Metal Strips	2.6.2	G												
		09 35 16	SD-03 Product Data														
			Quarry Tile	2.1.1	G												
			Recycled Content for Chemical-Resistant Quarry Tile	2.1.1	S												
			Grout	2.1.2	G												
			Indoor Air Quality for Mortar and Grout	2.1.2	S												
			SD-04 Samples														
			Quarry Tile	2.1.1	G												
			Grout	2.1.2	G												
			SD-06 Test Reports														
			Grout	2.1.2	G												
			SD-08 Manufacturer's Instructions														
			Quarry Tile	2.1.1													
			Grout	2.1.2	G												
		09 51 00	SD-02 Shop Drawings														
			Approved Detail Drawings	2.1	G												
			SD-03 Product Data														
			Acoustical Ceiling Systems	2.1.1	G												
			Fire Resistive Ceilings	2.1.1	G												

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		09 51 00	Recycled Content for Type III Ceiling Tiles	2.2.1.1	S												
			Recycled Content for Type III Ceiling Tiles	2.2.2.1	S												
			Recycled Content for Type IV Ceiling Tiles	2.2.1.1	S												
			Recycled Content for Type IV Ceiling Tiles	2.2.2.1	S												
			Recycled Content for Type IX Ceiling Tiles	2.2.1.1	S												
			Recycled Content for Type IX Ceiling Tiles	2.2.2.1	S												
			Recycled Content for Type XII Ceiling Tiles	2.2.1.1	S												
			Recycled Content for Type XII Ceiling Tiles	2.2.2.1	S												
			Recycled Content for Suspension Systems	2.3	S												
			Acoustical Performance	2.1.2	G												
			SD-04 Samples														
			Acoustical Units	2.2	G												
			Acoustical Ceiling Tiles	2.2.1.1	G												
			SD-06 Test Reports														
			Fire Resistive Ceilings	2.1.1	G												
			SD-07 Certificates														

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		09 51 00	Indoor Air Quality for Type III Ceiling Tiles	2.2.1.1	S												
			Indoor Air Quality for Type III Ceiling Tiles	2.2.2.1	S												
			Indoor Air Quality for Type IV Ceiling Tiles	2.2.1.1	S												
			Indoor Air Quality for Type IV Ceiling Tiles	2.2.2.1	S												
			Indoor Air Quality for Type V Ceiling Tiles	2.2.3.1	S												
			Indoor Air Quality for Type V Ceiling Tiles	2.2.6.1	S												
			Indoor Air Quality for Type VI Ceiling Tiles	2.2.3.1	S												
			Indoor Air Quality for Type VI Ceiling Tiles	2.2.6.1	S												
			Indoor Air Quality for Type VII Ceiling Tiles	2.2.3.1	S												
			Indoor Air Quality for Type VII Ceiling Tiles	2.2.6.1	S												
			Indoor Air Quality for Type IX Ceiling Tiles	2.2.1.1	S												
			Indoor Air Quality for Type IX Ceiling Tiles	2.2.2.1	S												
			Indoor Air Quality for Type X Ceiling Tiles	2.2.1.1	S												

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		09 51 00	Indoor Air Quality for Type X Ceiling Tiles	2.2.2.1	S												
			Indoor Air Quality for Type XI Ceiling Tiles	2.2.1.1	S												
			Indoor Air Quality for Type XI Ceiling Tiles	2.2.2.1	S												
			Indoor Air Quality for Type XII Ceiling Tiles	2.2.1.1	S												
			Indoor Air Quality for Type XII Ceiling Tiles	2.2.2.1	S												
			Indoor Air Quality for Impact/Abrasion Resistant Ceiling Tiles	2.2.4.1	S												
			Indoor Air Quality for Humidity Resistant Ceiling Tiles	2.2.5.1	S												
			Indoor Air Quality for Adhesives	2.6	S												
			Indoor Air Quality for Sealants	2.9	S												
		09 62 38	SD-03 Product Data														
			Static-Control Resilient Flooring	2.1	G												
			Recycled content for Conductive Vinyl Tile	2.1.1.1	S												
			Recycled content for Conductive Rubber Tile	2.1.1.2	S												
			Recycled content for Conductive Rubber Sheet Flooring	2.1.1.3	S												



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		09 62 38	Recycled content for Static-Dissipative Vinyl Tile	2.1.2.1	S												
			Recycled content for Static-Control Carpet	2.2	S												
			Accessories	2.6	G												
			Adhesives	2.4	G												
			Warranty	1.9													
			SD-04 Samples														
			Static-Control Resilient Flooring	2.1	G												
			Static-Control Carpet	2.2	G												
			Moldings	2.5	G												
			Special Treatment Materials	1.3.1.4	G												
			Accessories	2.6	G												
			SD-06 Test Reports														
			Fire Resistance	2.9													
			Moisture, Alkalinity and Bond	3.2													
			Testing	3.9													
			SD-07 Certificates														
			Indoor Air Quality for Conductive Vinyl Tile	2.1.1.1	S												
			Indoor Air Quality for Conductive Rubber Tile	2.1.1.2	S												
			Indoor Air Quality for Conductive Rubber Sheet Flooring	2.1.1.3	S												
			Indoor Air Quality for Static-Dissipative Vinyl Tile	2.1.2.1	S												

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		09 62 38	Indoor Air Quality for Static-Dissipative Rubber Tile	2.1.2.2	S												
			Indoor Air Quality for Static-Control Carpet	2.2	S												
			Indoor Air Quality for Adhesives	2.4	S												
			Qualifications of Applicator	1.6													
			SD-08 Manufacturer's Instructions														
			Static-Control Resilient Flooring	2.1	G												
			Accessories	2.6	G												
			SD-10 Operation and Maintenance														
			Data														
			Static-Control Resilient Flooring	2.1	G												
			Accessories	2.6	G												
		09 64 66	SD-02 Shop Drawings														
			Hardwood Strip Flooring	2.1													
			SD-03 Product Data														
			Hardwood Strip Flooring	2.1													
			Indoor Air Quality for Asphalt Fill	2.2.12	S												
			Indoor Air Quality for Asphalt	2.2.10	S												
			Primer														
			Indoor Air Quality for Asphalt	2.2.11	S												
			Mastic														
			Indoor Air Quality for Seal Coat and Finish Coat Materials	2.2.18	S												
			Indoor Air Quality for Game Line Marking Materials	2.2.19	S												

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																		(a)
		09 64 66	Indoor Air Quality for Adhesives	2.2.22	S													
			SD-04 Samples															
			Strip Flooring	2.2.1	G													
			Hardwood Base	2.2.2	G													
			Molded-Rubber Base	2.2.3	G													
			Steel Channels and Clips	2.2.5														
			Fiberboard Underlayment	2.2.6														
			Flexible Foam Underlayment	2.2.8														
			Cushions and Pads	2.2.7														
			Corkboard or Corkroll	2.2.21														
			Sleepers and Nailers	2.2.15														
			SD-06 Test Reports															
			Preservative Treatment	2.2.15														
			SD-07 Certificates															
			Certified Sustainably Harvested Wood Strip Flooring	2.2.1	S													
			Certified Sustainably Harvested Sleepers and Nailers	2.2.15	S													
			Certified Sustainably Harvested Wood Board Subflooring	2.2.16	S													
			Certified Sustainably Harvested Plywood Subflooring	2.2.17	S													
			Indoor Air Quality for Wood Strip Flooring	2.2.1	S													
			Indoor Air Quality for Molded-Rubber Base	2.2.3	S													

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		09 64 66	Indoor Air Quality for Fiberboard Underlayment	2.2.6	S												
			Indoor Air Quality for Rubber Cushions and Pads	2.2.7	S												
			Indoor Air Quality for Flexible Foam Underlayment	2.2.8	S												
			SD-08 Manufacturer's Instructions System	2.1													
			Adhesive	3.2.1													
			SD-10 Operation and Maintenance Data														
			Strip Flooring	2.2.1	G												
		09 65 00	SD-02 Shop Drawings														
			Resilient Flooring and Accessories	2.18	G												
			SD-03 Product Data														
			Resilient Flooring and Accessories	2.18	G												
			Adhesives	2.14													
			Vinyl Composition Tile	2.1													
			Recycled content for Vinyl Composition Tile	2.1	S												
			Sheet Vinyl Flooring	2.2													
			Recycled content for Sheet Vinyl Flooring	2.2	S												
			Luxury Vinyl Tile	2.5													

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		09 65 00	Recycled content for Luxury Vinyl Tile	2.5	S												
			Rubber Tile	2.3													
			Rubber Sheet Flooring	2.4													
			Solid Vinyl Tile	2.6													
			Cement-Fiber Board	2.15													
			Wall Base	2.10													
			Stair Treads, Risers and Stringers	2.12													
			Sheet Linoleum	2.7													
			Recycled content for Sheet Linoleum	2.7	S												
			Bio-based content for Sheet Linoleum	2.7	S												
			Linoleum Tile	2.8													
			Recycled content for Linoleum Tile	2.8	S												
			Bio-based content for Linoleum Tile	2.8	S												
			Cork Flooring	2.9													
			Recycled content for Cork Flooring	2.9	S												
			Bio-based content for Cork Flooring	2.9	S												
			SD-04 Samples														

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		09 65 00	Resilient Flooring and Accessories	2.18	G												
			SD-06 Test Reports														
			Moisture, Alkalinity and Bond Tests	3.3	G												
			SD-07 Certificates														
			Indoor Air Quality for Vinyl Composition Tile	2.1	S												
			Indoor Air Quality for Sheet Vinyl Flooring	2.2	S												
			Indoor Air Quality for Rubber Tile	2.3	S												
			Indoor Air Quality for Rubber Sheet Flooring	2.4	S												
			Indoor Air Quality for Luxury Vinyl Tile	2.5	S												
			Indoor Air Quality for Solid Vinyl Tile	2.6	S												
			Indoor Air Quality for Sheet Linoleum	2.7	S												
			Indoor Air Quality for Linoleum Tile	2.8	S												
			Indoor Air Quality for Cork Flooring	2.9	S												
			Indoor Air Quality for Wall Base	2.10	S												
			Indoor Air Quality for Adhesives	2.14	S												

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		09 65 00	Certified Sustainably Harvested Cork Flooring	2.9	S												
			SD-08 Manufacturer's Instructions														
			Surface Preparation	3.2	G												
			Installation	3.1	G												
			SD-10 Operation and Maintenance Data														
			Resilient Flooring and Accessories	2.18	G												
		09 65 66	SD-02 Shop Drawings														
			Approved Detail Drawings	3.3.6.1	G												
			SD-03 Product Data														
			Installation	3.3													
			Indoor Air Quality for Rubber Poured-In-Place Flooring	2.1.3	S												
			Indoor Air Quality for Urethane Poured-In-Place Flooring	2.1.6	S												
			Indoor Air Quality for Adhesives	2.3	S												
			Indoor Air Quality for Primer	2.6	S												
			Indoor Air Quality for Game Line Marking Materials	2.7	S												
			SD-04 Samples														
			Flooring	1.3.8													
			SD-06 Test Reports														
			Laboratory Test Results	1.3.4													
			SD-07 Certificates														

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		09 65 66	Indoor Air Quality for Indoor-Outdoor Carpeting	2.1.1	S												
			Indoor Air Quality for Rubber Composition Tile	2.1.2	S												
			Indoor Air Quality for Sheet Rubber Composition Flooring	2.1.4	S												
			Indoor Air Quality for Sheet Vinyl Composition Flooring	2.1.5	S												
			Indoor Air Quality for Resilient Mat Underlay	2.2	S												
			Indoor Air Quality for Wall Base	2.8	S												
			SD-11 Closeout Submittals Warranty	1.6													
		09 66 13	SD-02 Shop Drawings Installation	3.2	G												
			SD-03 Product Data Flooring System Materials	2.1													
			Recycled Content for Portland Cement Terrazzo Flooring System	2.1	S												
			Indoor Air Quality for Curing Material	2.8	S												
			Indoor Air Quality for Sealer	2.10	S												
			SD-04 Samples Terrazzo Flooring	3.2.5.3													
			Divider Strips	2.5													
			Control Joint Strips	2.6													



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		09 66 13	Colorants	2.7													
			SD-10 Operation and Maintenance Data														
			Cleaning and Sealing	3.3													
			SD-11 Closeout Submittals														
			Warranty	1.5													
		09 66 16	SD-02 Shop Drawings														
			Terrazzo Tile	2.2	G												
			SD-03 Product Data														
			Terrazzo Tile	2.2													
			Recycled Content for Terrazzo Tile	2.2	S												
			Adhesive	2.3													
			Indoor Air Quality for Adhesive Installation	2.3	S												
			Installation	3.5													
			SD-04 Samples														
			Terrazzo Tile	2.2													
			Terrazzo Base	2.4													
			Metal Edge Strips	2.6													
			SD-10 Operation and Maintenance Data														
			Manufacturer's Maintenance Instructions	3.7	G												
			SD-11 Closeout Submittals														
			Warranty	1.6													
		09 67 23.13	SD-02 Shop Drawings														

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		09 67 23.13	Installation Drawings	2.1	G												
			Fabrication Drawings	2.1	G												
			SD-03 Product Data														
			Manufacturer's Catalog Data	1.2.2	G												
			SD-04 Samples														
			Hardboard Mounted Epoxy Flooring	1.5.3	G												
			Floor Topping	3.1.5	G												
			Mockups	1.5.1	G												
			SD-05 Design Data														
			Design Mix Data	1.2.3	G												
			SD-07 Certificates														
			Listing of Product Installations	1.5.2													
			Referenced Standards	1.5													
			Certificates														
			SD-11 Closeout Submittals														
			Warranty	1.6	G												
		09 67 23.14	SD-02 Shop Drawings														
			Flooring Systems	2.2	G												
			SD-03 Product Data														
			Sealer and Resin	2.4	G												
			Floor Surfacing	3.3.2	G												
			Conductive Sparkproof Flooring	2.3	G												
			Indoor Air Quality for Primer	2.1.1	S												
			Indoor Air Quality for Top Coating	2.1.5	S												

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		09 67 23.14	Indoor Air Quality for Sealer And Resin	2.4	S												
			Mixing	3.2	G												
			SD-04 Samples														
			Flooring Systems	2.2	G												
			SD-06 Test Reports														
			Testing	3.4	G												
			SD-07 Certificates														
			Qualifications of Installer	1.3.1	G												
			SD-08 Manufacturer's Instructions														
			Application	3.3	G												
			SD-10 Operation and Maintenance														
			Data														
			Flooring Systems	2.2	G												
		09 67 23.15	SD-03 Product Data														
			Joint Sealant	2.1	G												
			Thin Film Flooring System	2.2	G												
			White Aluminum Oxide Non-Skid	2.3	G												
			Grit														
			SD-05 Design Data														
			Environmental Control System	1.3.3.1													
			SD-06 Test Reports														
			Joint Sealant Test Report	1.3.4.1	G												
			Primer Coat	2.2.1	G												
			Urethane Topcoat	2.2.2	G												

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		09 67 23.15	White Aluminum Oxide Non-Skid Grit	2.3	G												
			Patch Test Demonstration	1.7	G												
			Daily Inspection Report	1.3.4.2	G												
			Adhesion Testing	3.11.3	G												
			SD-07 Certificates														
			Coating Work Plan	1.3.2	G												
			Joint Sealant Certificates	1.3.5.5	G												
			Thin Film Flooring System Certificates	1.3.5.6	G												
			Qualifications of Certified Industrial Hygienist (CIH)	1.3.5.1													
			Qualifications of Certified Protective Coatings Specialist (PCS)	1.3.1													
			Qualifications of Coating Inspection Company														
			Qualifications of QC Specialist Coating Inspector	1.3.5.2													
			Qualifications of Coating Contractors	1.3.5.3													
			Warranty	1.3.5.4	G												
			SD-08 Manufacturer's Instructions	1.8	G												
			Joint Sealant Manufacturer's Instructions	1.3.6.1	G												

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		09 67 23.15	Thin Film Flooring System	1.3.6.2	G												
			Manufacturer's Instructions														
			Water-Based Alkaline Degreaser	1.3.6.3	G												
			SD-11 Closeout Submittals														
			Inspection Logbook	3.11.2.2	G												
		09 67 23.16	SD-03 Product Data														
			Joint Sealant	2.1	G												
			Epoxy Mortar Flooring System	2.2	G												
			White Aluminum Oxide Non-Skid	2.3	G												
			Grit														
			SD-05 Design Data														
			Environmental Control System	1.3.3.1													
			SD-06 Test Reports														
			Joint Sealant Test Report	1.3.4.1	G												
			Primer Coat	2.2.1	G												
			Epoxy Mortar Coat	2.2.2	G												
			Grout Coat	2.2.3	G												
			Urethane Topcoat	2.2.4	G												
			White Aluminum Oxide Non-Skid	2.3	G												
			Grit														
			Patch Test Demonstration	1.7	G												
			Daily Inspection Report	1.3.4.2	G												
			Adhesion Testing	3.13.3	G												
			SD-07 Certificates														
			Coating Work Plan	1.3.2	G												

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		09 67 23.16	Qualifications of Coating Contractors	1.3.5.5	G												
			Joint Sealant Certificates	1.3.5.6	G												
			Epoxy Mortar Flooring System Certificates	1.3.5.7	G												
			Qualifications of Certified Industrial Hygienist (CIH)	1.3.5.1													
			Qualifications of Certified Protective Coatings Specialist (PCS)	1.3.5.2													
			Qualifications of Coating Inspection Company	1.3.5.3													
			Qualifications of QC Specialist Coating Inspector	1.3.5.4													
			Warranty	1.8	G												
			SD-08 Manufacturer's Instructions														
			Joint Sealant Manufacturer's Instructions	1.3.6.1	G												
			Epoxy Mortar Flooring System Manufacturer's Instructions	1.3.6.2	G												
			Water-Based Alkaline Degreaser	1.3.6.3	G												
			SD-11 Closeout Submittals														
			Inspection Logbook	3.13.2.2	G												
		09 68 00	SD-02 Shop Drawings														
			Installation Drawings	3.4	G												
			SD-03 Product Data														

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		09 68 00	Carpet	2.1	G												
			Carpet Cushion	2.3	G												
			Recycled Content for Carpeting	2.1.1	S												
			Recycled Content for Fiber Cushion	2.3.1	S												
			Recycled Content for Rubber Cushion	2.3.2	S												
			Recycled Content for Polyurethane-Foam Cushion	2.3.3	S												
			Moldings	2.5	G												
			Indoor Air Quality for Aerosol Adhesives	2.4	S												
			Indoor Air Quality for Non-Aerosol Adhesives	2.4	S												
			Indoor Air Quality for Concrete Primer	2.4	S												
			SD-04 Samples														
			Carpet	2.1	G												
			Moldings	2.5	G												
			Carpet Cushion	2.3	G												
			SD-06 Test Reports														
			Moisture and Alkalinity Tests	3.2	G												
			SD-07 Certificates														
			Indoor Air Quality for Carpet	2.1.2	S												
			Indoor Air Quality for Fiber Cushion	2.3.1	S												

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		09 68 00	Indoor Air Quality for Rubber Cushion	2.3.2	S												
			Indoor Air Quality for Polyurethane-Foam Cushion	2.3.3	S												
			SD-08 Manufacturer's Instructions														
			Surface Preparation	3.1													
			SD-10 Operation and Maintenance Data														
			Cleaning and Protection	3.5													
			Maintenance Service	3.7.2													
			SD-11 Closeout Submittals														
			Warranty	1.6													
		09 69 13	SD-02 Shop Drawings														
			Detailed Installation Drawings	2.2.2	G												
			Fabrication Drawings	2.2.1	G												
			SD-03 Product Data														
			Access Flooring System	2.1	G												
			Access Flooring System	2.5	G												
			Recycled Content of Access Flooring System	2.1.1	S												
			Indoor Air Quality For Pedestal Adhesive	2.1.5	S												
			Indoor Air Quality For Concrete Sealer	2.2.3.5	S												
			Indoor Air Quality For Adhesives	2.2.7	S												
			SD-04 Samples														



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		09 69 13	Floor Panels	2.2													
			Floor Covering	2.2.4	G												
			Panel Support System	2.3													
			Accessories	2.2.5	G												
			Fascia	2.4	G												
			Exposed Step and Ramp Structure	2.5	G												
			Railings	2.6	G												
			Perforated Directional Air Supply Panels	2.10	G												
			Cut Outs	2.11	G												
			SD-05 Design Data														
			Seismic Calculations	2.1.7													
			SD-06 Test Reports														
			Factory Tests	2.7													
			Concentrated Load	2.1.1													
			Uniform Live Load	2.1.1													
			Rolling Load	2.1.1													
			Rolling Load	2.1.1													
			Impact Load	2.1.1													
			Ultimate Load	2.1.1													
			Stringer Load	2.1.3													
			Pedestal Axial Load	2.1.4													
			Bonding Strength of Pedestal Adhesive	2.1.5													
			Electrical Resistance	3.2.4													

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		09 69 13	Field Tests	3.2													
			SD-07 Certificates														
			Compliance with ICC-ES AC300	2.1													
			Compliance with ICC IBC	2.1													
			Certificate of Compliance	2.1													
			Qualification of Manufacturer	1.4.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.5	G												
			SD-11 Closeout Submittals														
			Lifting Device	2.2.8													
			Warranty	1.6	G												
		09 69 19	SD-02 Shop Drawings														
			Detailed Installation Drawings	2.2.2	G												
			Fabrication Drawings	2.2.1	G												
			SD-03 Product Data														
			Access Flooring System	2.1	G												
			Access Flooring System	2.5	G												
			Recycled Content For Access Flooring System	2.1.1	S												
			Indoor Air Quality For Pedestal Adhesive	2.1.4	S												
			Indoor Air Quality For Concrete Sealer	2.2.3.5	S												
			Indoor Air Quality For Adhesives	2.2.7	S												

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		09 69 19	SD-04 Samples														
			Floor Panels	2.2													
			Floor Covering	2.2.4	G												
			Panel Support System	2.3													
			Accessories	2.2.5	G												
			Fascia	2.4	G												
			Exposed Step and Ramp Structure	2.5	G												
			Railings	2.6	G												
			Perforated Directional Air Supply Panels	2.10	G												
			Cut Outs	2.11	G												
			SD-05 Design Data														
			Seismic Calculations	2.1.6													
			SD-06 Test Reports														
			Factory Tests	2.7													
			Concentrated Load	2.1.1													
			Uniform Live Load	2.1.1													
			Rolling Load	2.1.1													
			Rolling Load	2.1.1													
			Impact Load	2.1.1													
			Ultimate Load	2.1.1													
			Pedestal Axial Load	2.1.3													
			Bonding Strength of Pedestal Adhesive	2.1.4													
			Electrical Resistance	3.2.4													

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		09 69 19	Field Tests	3.2													
			SD-07 Certificates														
			Compliance with ICC-ES AC300	2.1													
			Compliance with ICC IBC	2.1													
			Certificate of Compliance	2.1													
			Qualification of Manufacturer	1.4.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.5	G												
			SD-11 Closeout Submittals														
			Lifting Device	2.2.8													
			Warranty	1.6	G												
		09 72 00	SD-03 Product Data														
			Wallcoverings and Accessories	2.1	G												
			Primer and Adhesive	2.10													
			Recycled Content for vinyl wallcovering	2.2	S												
			Recycled Content for textile wallcovering	2.3	S												
			Recycled Content for acoustical wallcovering	2.4	S												
			Recycled Content for wallcovering border	2.5	S												
			SD-04 Samples														
			Wallcoverings and Accessories	2.1	G												

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		09 72 00	SD-07 Certificates														
			Indoor Air Quality	1.3.1	S												
			SD-08 Manufacturer's Instructions														
			Wallcoverings and Accessories	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Wallcoverings and Accessories	2.1	G												
		09 84 20	SD-02 Shop Drawings														
			Approved Detail Drawings	2.2	G												
			SD-03 Product Data														
			Installation	3.2													
			Acoustical Wall Panels	2.2	G												
			Recycled Content for Wood Panels	2.1.1.1	S												
			Recycled Content for Fabric Panels	2.1.1.3	S												
			Indoor Air Quality for Composite Wood and Agrifiber Products	2.1.1.3	S												
			SD-04 Samples														
			Acoustical Wall Panels	2.2	G												
			SD-07 Certificates														
			Acoustical Wall Panels	2.2													
			Certified Sustainably Harvested Wood	1.3.1	S												
			SD-11 Closeout Submittals														
			Warranty	1.5													

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		09 90 00	SD-02 Shop Drawings														
			Piping Identification	3.12													
			SD-03 Product Data														
			Coating	2.1	G												
			Product Data Sheets	2.1													
			Sealant	3.3.5													
			SD-04 Samples														
			Color	2.3	G												
			Textured Wall Coating System	1.6.7	G												
			Sample Textured Wall Coating	1.6.8	G												
			System Mock-Up														
			SD-07 Certificates														
			Qualification Testing	1.6.6.2	G												
			Indoor Air Quality for Paints and Primers	1.6.5													
			Indoor Air Quality for Consolidated Latex Paints	1.6.5													
			SD-08 Manufacturer's Instructions														
			Application Instructions	3.4.1													
			Mixing	2.1													
			Manufacturer's Safety Data	1.8.1													
			Sheets														
			SD-10 Operation and Maintenance														
			Data														
			Coatings	2.1	G												
		09 96 00	SD-01 Preconstruction Submittals														

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		09 96 00	Equipment List	1.3	G												
			SD-03 Product Data														
			Heat-Resistant Coatings	2.1.1	G												
			Epoxy Coatings	2.2.1	G												
			Polyurethane Coatings	2.2.2	G												
			Chlorinated-Rubber Coatings	2.2.3	G												
			SD-04 Samples														
			Color Chips	1.3	G												
			SD-07 Certificates														
			Heat-Resistant Coatings	2.1.1	G												
			Epoxy Coatings	2.2.1	G												
			Polyurethane Coatings	2.2.2	G												
			Chlorinated-Rubber Coatings	2.2.3	G												
			Manufacturer's Printed Instructions	3.1.4	G												
		09 96 59	SD-03 Product Data														
			High-Build Glaze Coatings	2.1.4													
			SD-04 Samples														
			High-Build Glaze Coatings	2.1.4	G												
			Coating System	2.1.4	G												
			SD-06 Test Reports														
			Filler Material	2.1.1													
			Primers	2.1.2													
			Top Coating	2.1.3													
			SD-07 Certificates														
			Qualifications of Installer	1.5													

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		09 96 59	SD-08 Manufacturer's Instructions														
			Wall Coating System	2.1													
		09 97 02	SD-01 Preconstruction Submittals														
			Safety, Health, and	1.3	G												
			Environmental Requirements														
			Accident Prevention Plan	1.3.1	G												
			Confined Spaces Plan	1.3.1.6	G												
			Respiratory Protection Plan	1.3.1.7	G												
			Airborne Sampling Plan	1.3.2.1	G												
			Ventilation Assessment Plan	1.3.1	G												
			Medical Surveillance Plan	1.3.2	G												
			Worker Protection Plan	1.3.2.2	G												
			Environmental Protection Plan	1.3.3	G												
			Waste Manifest	1.3.3.1													
			Waste Disposal Plan	1.3.3.1	G												
			Containment Plan	1.3.3.2	G												
			Visible Emissions Monitoring	1.3.3.3	G												
			Plan														
			PM-10 Monitoring Plan	1.3.3.4	G												
			TSP Monitoring Plan	1.3.3.5	G												
			Water Quality Plan	1.3.3.6	G												
			Soil Quality Plan	1.3.3.7	G												
			SD-03 Product Data														
			Manufacturer's Safety Data Sheet	2.1	G												
			SD-04 Samples														
			Product Samples	2.1	G												



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		09 97 02	Special Paint Formulas	2.2	G												
			Solvent and Thinners	2.4.3	G												
			SD-06 Test Reports														
			PM-10 Test Report	1.3.3.4													
			TSP Test Report	1.3.3.5													
			Soil Quality Test Report	1.3.3.7													
			Inspection Reports	3.4													
			Medical Status Records	1.3.2.2													
			Change in Medical Status Report	1.3.2.3													
			Air Monitoring Test Plan	1.3.2.1	G												
			Air Monitoring Test Report	1.3.2.1													
			SD-07 Certificates														
			Certified EHS Professional	1.5.1													
			Certified Lead Laboratory	1.5.2													
			SSPC [QP 1][QP-2][QP-3]	1.5.3	G												
			Certificate														
			Qualified Hazardous Paint	1.5.4	G												
			Removal Contractor														
			Coating Thickness Gage	1.5.7													
			Qualification														
			Qualified Coating Applicator	1.5.6	G												
		09 97 13.00 40	SD-01 Preconstruction Submittals														
			Inspection Forms	3.3.1.1	G												
			Safety Plan	1.3	G												
			SD-03 Product Data														
			Abrasive Blasting Material	2.1.1	G												

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		09 97 13.00 40	Sealant Compound	2.1.2	G												
			Inorganic Zinc	2.1.3.1	G												
			Inhibitive Polyamide Epoxy	2.1.3.1	G												
			Aliphatic Polyurethane	2.1.3.1	G												
			SD-04 Samples														
			Manufacturer's Standard Color Charts	1.3	G												
			Inspection Forms	3.3.1.1	G												
			SD-05 Design Data														
			Inorganic Zinc	2.1.3.1	G												
			Inhibitive Polyamide Epoxy	2.1.3.1	G												
			Aliphatic Polyurethane	2.1.3.1	G												
			SD-06 Test Reports														
			Inspection Reports	3.3.1.2	G												
			SD-07 Certificates														
			Abrasive Blasting Material	2.1.1													
			Sealant Compound	2.1.2													
			Inhibitive Polyamide Epoxy	2.1.3.1													
			Aliphatic Polyurethane	2.1.3.1													
			SD-08 Manufacturer's Instructions														
			Protective Coatings	2.1.3													
		09 97 13.16	SD-05 Design Data														
			Environmental Control System	1.4.4.1													
			SD-06 Test Reports														
			Metallic Abrasive Qualification Test Reports	1.4.5.1													

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		09 97 13.16	Coating Sample Test Reports	3.2.3													
			Abrasive Sample Test Reports	3.2.4													
			Inspection Report Forms	3.11.2.2													
			Daily Inspection Reports	3.11.2.3													
			Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)	1.4.5.2													
			SD-07 Certificates														
			Contract Errors, Omissions, and Other Discrepancies	1.4.1													
			Corrective Action Procedures	1.4.2.1													
			Coating Work Plan	1.4.3													
			Qualifications of Certified Industrial Hygienist (CIH)	1.4.6.1													
			Qualifications Of Individuals Performing Abrasive Blasting	1.4.6.5													
			Qualifications of Certified Protective Coatings Specialist (PCS)	1.4.6.2													
			Qualifications of Coating Inspection Company	1.4.6.3													
			Qualifications of QC Specialist Coating Inspector	1.4.6.4													
			Qualifications of Testing Laboratory for Coatings	1.4.6.6													
			Qualifications of Testing Laboratory for Abrasive	1.4.6.7													

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		09 97 13.16	Qualifications of Coating Contractors	1.4.6.8													
			Roof Joint Sealant Materials	1.4.6.9													
			Roof Joint Sealant Compatibility	1.4.6.10													
			Epoxy Coating Materials	1.4.6.11													
			Non-metallic Abrasive	1.4.6.12													
			Metallic Abrasive	1.4.6.13													
			SD-08 Manufacturer's Instructions														
			Roof Joint Sealant Instructions	1.5.1													
			Coating System Instructions	1.5.2													
			SD-11 Closeout Submittals														
			Disposal of Used Abrasive	3.8.6	G												
			Inspection Logbook	3.11.2.4	G												
		09 97 13.17	SD-01 Preconstruction Submittals														
			Contract Errors, Omissions, and Other Discrepancies	1.4.1													
			Corrective Action Procedures	1.4.2.1													
			Corrective Action Request (CAR) Form	1.4.2.2													
			Coatings Work Plan	1.4.3													
			Inspection Report Form	3.12.1.2													
			SD-05 Design Data														
			Environmental Control System	1.4.4.1													
			Use of Door Sheet Access Way	1.4.4.2	G												
			SD-06 Test Reports														

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		09 97 13.17	Coatings Qualification Test Reports	1.4.5.1													
			Joint Sealant Qualification Test Reports	1.4.5.2													
			Non-Metallic Abrasive Qualification Test Reports	1.4.5.4	G												
			Ferrous Metallic Abrasive Qualification Test Reports	1.4.5.3													
			Coating Field Test Reports	3.3.3													
			Abrasive Field Test Reports	3.3.4													
			Recycled Ferrous Metallic Abrasive Field Test Reports (Daily and Weekly)	1.4.5.5													
			Daily Inspection Reports	3.12.1.3													
			SD-07 Certificates														
			Qualifications of Certified Industrial Hygienist (CIH)	1.4.6.1													
			Qualifications of Certified Protective Coatings Specialist (PCS)	1.4.6.2													
			Qualifications of Coatings Inspection Company	1.4.6.3													
			Qualifications of Quality Assurance Coatings Inspector	1.4.6.4													
			Qualifications of Coatings Contractors	1.4.6.5													

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		09 97 13.17	Qualifications of Individuals Performing Abrasive Blasting	1.4.6.6													
			Qualifications of Individuals Applying Coatings	1.4.6.7													
			Qualifications of Testing Laboratory for Coatings	1.4.6.8													
			Qualifications of Testing Laboratory for Abrasive	1.4.6.9													
			Coating Materials Certificate of Conformance	1.4.6.10													
			Joint Sealant Materials Certificate of Conformance	1.4.6.11													
			Joint Sealant Compatibility	1.4.6.12													
			Non-Metallic Abrasive Certificate of Conformance	1.4.6.14													
			Ferrous Metallic Abrasive Certificate of Conformance	1.4.6.13													
			SD-08 Manufacturer's Instructions														
			Joint Sealant Instructions	1.5.1													
			Coating System Instructions	1.5.2													
			SD-11 Closeout Submittals														
			Disposal of Used Abrasive	3.9.6	G												
			Inspection Logbook	3.12.1.4	G												
			Corrective Action Log	1.4.2.3	G												
		09 97 13.25	SD-02 Shop Drawings														
			Steel	1.11.1	G												

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		09 97 13.25	Stainless Steel	1.11.1	G												
			Aluminum	1.11.1	G												
			SD-03 Product Data														
			Exothermic Weld Kits	2.6.1	G												
			Load Indicator Washers	2.4.1.4	G												
			SD-05 Design Data														
			Containment System	3.6	G												
			SD-06 Test Reports														
			Non-metallic Abrasive Media	1.11.4.1	G												
			Coatings	1.11.4.2	G												
			Bolts, Nuts, and Washers	2.4	G												
			Metallic Abrasive Media	1.11.4.3	G												
			Daily inspection checklist	1.11.4.4	G												
			Coating Sample Testing	3.2.2	G												
			Recycled Metallic Abrasive Media	1.11.4.5	G												
			SD-07 Certificates														
			Coating System	2.7	G												
			Abrasive Media	1.11.3.7	G												
			Coating System Compatibility	1.11.3.8	G												
			Galvanizing	2.5	G												
			Bolts, Nuts, and Washers	2.4	G												
			Work plan	1.11.3.1	G												
			Qualifications of Certified Industrial Hygienist (CIH)	1.11.3.2	G												
			Qualifications of Testing Laboratory for Coatings	1.11.3.3	G												

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		09 97 13.25	Qualifications of Testing Laboratory for Abrasive Media	1.11.3.4	G												
			Qualifications of Coating Contractors	1.11.3.5	G												
			Qualifications of Painting Shop	1.11.3.6	G												
			SD-08 Manufacturer's Instructions Coating system	2.7	G												
			SD-11 Closeout Submittals Disposal of used abrasive	3.8.7	G												
		09 97 13.27	SD-05 Design Data Containment System	1.4.4.1													
			SD-06 Test Reports Joint Sealant Qualification Test Reports	1.4.5.1													
			Coatings Qualification Test Reports	1.4.5.2													
			Metallic Abrasive Qualification Test Reports	1.4.5.3													
			Coating Sample Test Reports	3.2.3													
			Abrasive Sample Test Reports	3.2.4													
			Inspection Report Forms	3.9.2.2													
			Daily Inspection Reports	3.9.2.3													
			Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)	1.4.5.4													
			SD-07 Certificates														



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		09 97 13.27	Contract Errors, Omissions, and Other Discrepancies	1.4.1													
			Corrective Action Procedures	1.4.2.1													
			Coating Work Plan	1.4.3													
			Qualifications of Certified Industrial Hygienist (CIH)	1.4.6.1													
			Qualifications Of Individuals Performing Abrasive Blasting	1.4.6.5													
			Qualifications of Certified Protective Coatings Specialist (PCS)	1.4.6.2													
			Qualifications of Coating Inspection Company	1.4.6.3													
			Qualifications of QC Specialist Coating Inspector	1.4.6.4													
			Qualifications of Testing Laboratory for Coatings	1.4.6.6													
			Qualifications of Testing Laboratory for Abrasive	1.4.6.7													
			Qualifications of Coating Contractors	1.4.6.8													
			Joint Sealant Materials	1.4.6.9													
			Coating Materials	1.4.6.10													
			Coating System Component Compatibility	1.4.6.11													
			Non-metallic Abrasive	1.4.6.12													

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		09 97 13.27	Metallic Abrasive	1.4.6.13													
			SD-08 Manufacturer's Instructions														
			Joint Sealant Instructions	1.5.1													
			Coating System Instructions	1.5.2													
			SD-11 Closeout Submittals														
			Disposal of Used Abrasive	3.6.6													
			Inspection Logbook	3.9.2.4	G												
		09 97 13.28	SD-03 Product Data														
			Factory-applied Coating System	2.1.2													
			Field-applied Epoxy Coating	2.1.3													
			Thermosetting epoxy coating system	2.1.3													
			Polyethylene-Butyl Adhesive Coating System	2.1.4													
			Adhesive Thermoplastic Resin Coating System	2.1.2													
			Tape Coating System	2.1.1													
			Electrical-flaw Detector	3.2.2													
			Mastics	2.1.5													
			Rock Shield	2.1.6													
			SD-06 Test Reports														
			Inspector's Certificate	3.2.2													
			Field-applied Epoxy Coating	2.1.3													
			SD-08 Manufacturer's Instructions														
			Field-applied Epoxy Coating	2.1.3													

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		09 97 13.28	Thermosetting Epoxy Coating System	2.1.3													
			Electrical-flaw Detector	3.2.2													
			Mastics	2.1.5													
			Rock Shield	2.1.6													
		09 97 23	SD-03 Product Data														
			Graded Iron	2.3.1													
			Curing Compound	2.4													
			Water Reducing Admixture	2.1.3													
			High Range Water Reducing Admixture	2.1.3													
			SD-04 Samples														
			Conductive and Spark-Resistant Floor Finish	1.7													
			SD-05 Design Data														
			Mix Design	3.3.1													
			SD-06 Test Reports														
			Cement	2.1.1													
			Aggregate	2.1.2													
			Admixtures	2.1.3													
			Conductivity and Spark Resistance	3.5.2													
			Water	2.1.4													
			SD-08 Manufacturer's Instructions														
			Metallic Surfacing	3.4.3													
			Curing	3.4.5													

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		09 97 23	SD-10 Operation and Maintenance Data														
			Conductive Spark-Resistant Floor Finish	2.3.1	G												
		09 97 23.17	SD-01 Preconstruction Submittals														
			List of Proposed Subcontractors	1.3.1	G												
			List of Proposed Products	2.1	G												
			Health and Safety Plan	1.6	G												
			Reinforcement Corrosion Rate Testing Procedures and Equipment	1.9.3.1	G												
			Environmental Protection Plan	1.4.1	G												
			SD-02 Shop Drawings														
			Structure Corrosion Inhibitor System Application Areas	1.9.4	G												
			Structure Repair Areas Prior to Inhibitor System Application	1.9.1	G												
			Structure Testing Locations	1.9.4	G												
			Structure Reinforcing Steel Test	1.9.1	G												
			Wire Installation Locations and Installation Details														
			SD-03 Product Data														
			Vapor Phase Corrosion Inhibitor	2.2.1	G												
			Ionic Corrosion Inhibitor	2.2.2	G												
			Surface Sealant	2.2.3	G												
			Structure Repair Materials	1.9.1	G												

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		09 97 23.17	Structure Reinforcing Steel Test Wire	2.2.4	G												
			Structure Reinforcing Steel Test Wire Enclosure	2.2.5	G												
			Manufacturer's Storage and Handling Instructions	1.5	G												
			SD-06 Test Reports														
			Corrosion Inhibitor Selection and Application Plan	1.9.4	G												
			Pre-Project Test Application Report	1.9.3.2.1	G												
			Daily Checklists	3.1	G												
			Final Acceptance Test Report and Maintenance Test Procedure	3.7	G												
			SD-07 Certificates														
			Manufacturer's Certificate	1.3.2.1	G												
			Applicator's Certificate	1.3.1	G												
			Evidence of Acceptable Variation Certificate	1.3.3	G												
			SD-08 Manufacturer's Instructions														
			Safety Data Sheets (SDS)	2.1	G												
			Special Application Procedures For Extreme Temperatures	2.1	G												
			SD-11 Closeout Submittals														
			Final acceptance Test Report	3.7	G												
		10 11 00	SD-02 Shop Drawings														

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		10 11 00	Placement Schedule	3.1	G												
			SD-03 Product Data														
			Visual Display Unit	1.2	G												
			Visual Display Unit	2.1	G												
			Projection Screen	2.10	G												
			SD-04 Samples														
			Aluminum	2.1.6	G												
			Hardwood	2.1.7	G												
			Porcelain Enamel	2.1.1	G												
			Cork	2.1.2	G												
			Fabric	2.1.3	G												
			Vinyl Wall Covering	2.1.5	G												
			Glass	2.1.8	G												
			SD-07 Certificates														
			Indoor air quality for markerboards	2.3.1	S												
			Indoor air quality for tackboards	2.4	S												
			Indoor air quality for projection screen	2.10	S												
			Certificate of Compliance	1.2													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Cleaning Instructions	3.3													
			Manufacturer's Printed Installation Instructions	3.2	G												
		10 14 00.10	SD-02 Shop Drawings														

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		10 14 00.10	Approved Detail Drawings	3.1	G												
			SD-03 Product Data														
			Modular Exterior Signage System	2.1													
			Installation	3.1													
			Exterior Signage	1.2	G												
			Wind Load Requirements	1.2.1													
			SD-04 Samples														
			Exterior Signage	1.2	G												
			SD-10 Operation and Maintenance														
			Data														
			Protection and Cleaning	3.1.2	G												
		10 14 00.20	SD-02 Shop Drawings														
			Detail Drawings	1.4.2	G												
			SD-03 Product Data														
			Room Identification And Directional Signage System	2.1	G												
			Room Identification Sign with Patient Information	2.2	G												
			Stair Signage	2.3	G												
			Exit Door Tactile Sign	2.4	G												
			Building Directories	2.5	G												
			Door Tags	2.6	G												
			SD-04 Samples														
			Interior Signage	1.4.1	G												
			Software	1.3	G												

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		10 14 00.20	Room Identification And Directional Signage System	2.1	G												
			Room Identification Sign with Patient Information	2.2	G												
			Stair Signage	2.3	G												
			Exit Door Tactile Sign	2.4	G												
			Building Directories	2.5	G												
			Door Tags	2.6	G												
			SD-10 Operation and Maintenance Data														
			Approved Manufacturer's Instructions	3.2	G												
			Protection and Cleaning	3.2.2	G												
		10 14 53	SD-03 Product Data														
			Traffic Sign Posts	2.1													
			FHWA Acceptance Letter	2.1.3													
			Traffic Sign Retroreflective Sheeting	2.4													
			SD-04 Samples														
			Flexible Posts	2.6.2													
		10 21 13	SD-02 Shop Drawings														
			Fabrication Drawings	2.1													
			Installation Drawings	3.3	G												
			SD-03 Product Data														
			Cleaning and Maintenance Instructions	2.1													



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		10 21 13	Colors And Finishes	2.9													
			Painted Metal	2.2.1													
			Sound-Deadening Cores	2.2.7													
			Anchoring Devices and Fasteners	2.2.8													
			Hardware and Fittings	2.2.10													
			Brackets	2.2.9													
			Door Hardware	2.2.11													
			Toilet Enclosures	2.3.1													
			Room Entrance Screens	2.3.2													
			Urinal Screens	2.3.3													
			Pilaster Shoes	2.7													
			Finishes	2.2.10.2	G												
			Finishes	2.9.2	G												
			Recycled content for painted steel partitions and screens	2.3	S												
			Recycled content for stainless steel partitions and screens	2.3	S												
			Recycled content for plastic laminate partitions and screens	2.3	S												
			Recycled content for solid phenolic partitions and screens	2.3	S												
			SD-04 Samples														
			Colors and Finishes	2.9	G												
			Hardware and Fittings	2.2.10													

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		10 21 13	Anchoring Devices and Fasteners	2.2.8													
			SD-07 Certificates														
			Warranty	1.6													
			Indoor air quality for plastic laminate clad partitions and screens	2.3	S												
			Indoor air quality for solid phenolic, black core partitions and screens	2.3	S												
			SD-10 Operation and Maintenance Data														
			Plastic Identification	2.1.1	G												
		10 22 13	SD-02 Shop Drawings														
			Wire Mesh Partitions	1.4													
			SD-03 Product Data														
			Wire Mesh Partitions	1.4													
			Recycled Content for Metal Post and Framing Materials	2.1	S												
			Recycled Content for Wire Materials	2.1	S												
		10 22 19	SD-02 Shop Drawings														
			Installation	3.3													
			SD-03 Product Data														
			Warranty	1.7	G												
			Partition System	2.2	G												

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		10 22 19	Partition System	2.2	G												
			Recycled content for gypsum board	2.3.1	S												
			Recycled content for paper facing	2.3.1	S												
			Recycled content for gypsum cores	2.3.1	S												
			SD-04 Samples														
			Partition System Samples	2.4	G												
			Mock-Up	2.2	G												
			SD-07 Certificates														
			Burning Characteristics	2.1.1													
			Acoustical Performance	2.1.2													
			Structural Performance	2.1.3													
			Indoor air quality for gypsum board	2.3.1	S												
			Indoor air quality for aerosol adhesives	2.3.1.1	S												
			SD-10 Operation and Maintenance Data														
			Assembly Manuals	2.3.1	G												
			Maintenance Manuals	3.5	G												
		10 26 00	SD-02 Shop Drawings														
			Corner Guards	2.2	G												
			Wall Guards	2.3	G												
			Door Protectors	2.4	G												
			Wall Covering and Panels	2.5	G												

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		10 26 00	SD-03 Product Data														
			Corner Guards	2.2	G												
			Wall Guards	2.3	G												
			Door Protectors	2.4	G												
			Wall Covering and Panels	2.5	G												
			Recycled content for aluminum component of corner guards	2.2.1	S												
			Recycled content for steel component of corner guards	2.2.2	S												
			Recycled content for aluminum component of wall guards, Combination Handrail/Wall guard and handrails	2.3	S												
			Recycled content for aluminum component of crash rail/bed locators	2.3.1	S												
			Recycled content for aluminum component of combination handrail/crash rail	2.3.2	S												
			Recycled content for aluminum component of handrails	2.3.3	S												
			SD-04 Samples														
			Corner Guards	2.2	G												
			Wall Guards	2.3	G												
			Door Protectors	2.4	G												
			Wall Covering and Panels	2.5	G												

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		10 26 00	SD-06 Test Reports															
			Fire Resistance Rating	2.1.1.2														
			SD-07 Certificates															
			Indoor air quality for wall covering/panels	2.5	S													
			Indoor air quality for adhesives	2.8	S													
			SD-10 Operation and Maintenance Data															
			Corner Guards	2.2	G													
			Wall Guards	2.3	G													
			Door Protectors	2.4	G													
			Wall Covering and Panels	2.5	G													
		10 28 13	SD-02 Shop Drawings															
			Product Schedule	2.1	G													
			SD-03 Product Data															
			Recycled content for stainless steel toilet accessories	2.1	S													
			Item A4995	2.1.3	G													
			Item A5030	2.1.4	G													
			Item A5047	2.1.5	G													
			Item A5074	2.1.6	G													
			Item A5080	2.1.7	G													
			Item A5081	2.1.8	G													
			Item A5082	2.1.9	G													
			Item A5083	2.1.10	G													
			Item A5084	2.1.11	G													

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		10 28 13	Item A5090	2.1.12	G												
			Item A5109	2.1.13	G												
			Item A5110	2.1.14	G												
			Item A5112	2.1.15	G												
			Item A5115	2.1.16	G												
			Item A5135	2.1.17	G												
			Item A5140	2.1.18	G												
			Item A5145	2.1.19	G												
			Item A5150	2.1.20	G												
			Item A5160	2.1.21	G												
			Item A5162	2.1.22	G												
			Item A5165	2.1.23	G												
			Item A5166	2.1.24	G												
			Item A5170	2.1.25	G												
			Item A5175	2.1.26	G												
			Item A5195	2.1.27	G												
			Item A5196	2.1.28	G												
			Item A5200	2.1.29	G												
			Item A5202	2.1.30	G												
			Item A5205	2.1.31	G												
			Item A5207	2.1.32	G												
			Item L1200	2.1.33	G												
			SD-07 Certificates														
			Baby Changing Stations	1.3.1													
			SD-10 Operation and Maintenance														
			Data														

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		10 28 13	Item A4995	2.1.3	G												
			Item A5030	2.1.4	G												
			Item A5047	2.1.5	G												
			Item A5074	2.1.6	G												
			Item A5080	2.1.7	G												
			Item A5081	2.1.8	G												
			Item A5082	2.1.9	G												
			Item A5083	2.1.10	G												
			Item A5084	2.1.11	G												
			Item A5090	2.1.12	G												
			Item A5109	2.1.13	G												
			Item A5110	2.1.14	G												
			Item A5112	2.1.15	G												
			Item A5115	2.1.16	G												
			Item A5135	2.1.17	G												
			Item A5140	2.1.18	G												
			Item A5145	2.1.19	G												
			Item A5150	2.1.20	G												
			Item A5160	2.1.21	G												
			Item A5162	2.1.22	G												
			Item A5165	2.1.23	G												
			Item A5166	2.1.24	G												
			Item A5170	2.1.25	G												
			Item A5175	2.1.26	G												
			Item A5195	2.1.27	G												
			Item A5196	2.1.28	G												

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		10 28 13	Item A5200	2.1.29	G												
			Item A5202	2.1.30	G												
			Item A5205	2.1.31	G												
			Item A5207	2.1.32	G												
			Item L1200	2.1.33	G												
		10 44 16	SD-02 Shop Drawings														
			Fire Extinguishers	2.1.1	G												
			Accessories	Part 2	G												
			Cabinets	Part 2	G												
			Wall Brackets	2.2.2	G												
			Schedule	1.5	G												
			SD-03 Product Data														
			Fire Extinguishers	2.1.1	G												
			Accessories	Part 2	G												
			Cabinets	Part 2	G												
			Wall Brackets	2.2.2	G												
			Replacement Parts List	3.2.1	G												
			SD-04 Samples														
			Equipment Samples	1.3.1	G												
			SD-07 Certificates														
			Fire Extinguishers Certifications	2.1.1	G												
			Manufacturer's Warranty with Inspection Tag	1.4	G												
		10 51 13	SD-02 Shop Drawings														
			Types	2.1	G												
			Location	1.4	G												



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		10 51 13	Installation	3.1													
			Numbering system	3.2													
			SD-03 Product Data														
			Material	2.2													
			Locking Devices	2.3.1													
			Lock Control Chart	2.3.1													
			Handles	2.3.4													
			Finish	2.2.3													
			components	2.3													
			Assembly	3.1													
			SD-04 Samples														
			Color chips	1.5.1	G												
		12 21 00	SD-02 Shop Drawings														
			Installation	3.3													
			SD-03 Product Data														
			Window Blinds	2.1	G												
			Recycled Content for aluminum components	2.1	S												
			SD-04 Samples														
			Window Blinds	2.1	G												
			Valance	2.1.3.4	G												
			SD-06 Test Reports														
			Window Blinds	2.1													
			SD-07 Certificates														
			Indoor Air Quality for window blinds	2.1	S												

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		12 21 00	Indoor Air Quality for window blinds	2.1	S												
			SD-08 Manufacturer's Instructions														
			Window Blinds	2.1	G												
			SD-10 Operation and Maintenance Data														
			Window Blinds	2.1	G												
		12 22 00	SD-02 Shop Drawings														
			Drawings	1.4	G												
			SD-03 Product Data														
			Drapery System	1.5													
			SD-04 Samples														
			Drapery Fabric	2.1.1.1	G												
			Motor and Controller	1.4	G												
			Motor and Controller	2.1.4.5	G												
			Finished Drapery	3.2													
			SD-06 Test Reports														
			Flame Resistance	2.1.1.3													
			SD-07 Certificates														
			Indoor Air Quality for Fabrics	2.1.1	S												
			SD-08 Manufacturer's Instructions														
			Drapery Hardware	2.1.4													
			Motor and Controller	1.4													
			Motor and Controller	2.1.4.5													
			Fabrication	2.2.1													

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		12 22 00	SD-10 Operation and Maintenance Data														
			Drapery System	1.5	G												
			Motor and Controller	1.4													
			Motor and Controller	2.1.4.5													
		12 35 30.23 20	SD-02 Shop Drawings														
			Vanities	2.1	G												
		12 35 39	SD-01 Preconstruction Submittals														
			Field Verification Data	1.3.1	G												
			SD-02 Shop Drawings														
			Foodservice Configuration	1.3.2	G												
			Equipment Schedule	1.3	G												
			SD-03 Product Data														
			Recycled Content for steel components	2.1	S												
			SD-04 Samples														
			Closure Panels	2.2.2.1	G												
		12 35 70	SD-02 Shop Drawings														
			Detail Drawings	2.1	G												
			SD-03 Product Data														
			Casework	2.1													
			Recycled Content for Baked Enamel Carbon Steel Medical Casework	2.1.1.1	S												
			Recycled Content for Corrosion Resisting Steel Medical Casework	2.1.1.1	S												

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		12 35 70	Recycled Content for Wood Core Medical Casework	2.1.1.1	S												
			Recycled Content for Carbon Steel Medical Casework	2.1.1.1	S												
			Recycled Content for Wood Core Dental Casework	2.1.2	S												
			Recycled Content for Carbon Steel Dental Casework	2.1.2	S												
			Recycled Content for Baked Enamel Carbon Steel Dental Prosthetics Casework	2.1.3	S												
			Recycled Content for Corrosion Resisting Steel Dental Prosthetics Casework	2.1.3	S												
			Recycled Content for Corrosion Resisting Steel Countertops	2.1.4.1	S												
			Recycled Wood Content for Plastic Laminate Countertops	2.1.4.1	S												
			SD-04 Samples Casework	2.1	G												
			Wall Hung Cabinets	3.1.1	G												
			Floor Mounted Cabinets	3.1.2	G												
			Countertops	3.1.3	G												
			Laminated Plastic Sheets	2.1.2	G												
			SD-07 Certificates														

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		12 35 70	Certified Sustainably Harvested Wood for Medical Casework	2.1.1.2	S												
			Certified Sustainably Harvested Wood for Countertops	2.1.4.2	S												
			Indoor Air Quality for Composite Wood and Agrifiber Products Used In Countertops	2.1.4.3	S												
			SD-08 Manufacturer's Instructions Installation	2.1													
		12 48 13	SD-02 Shop Drawings Installation Drawings	3.2	G												
			Detail Drawings	3.2	G												
			Custom Graphics Drawings	3.2	G												
			SD-03 Product Data Entrance Floor Mats and Frames	2.1.1	G												
			Adhesives and Concrete Primers	2.1.2	G												
			SD-04 Samples Entrance Floor Mats and Frames	2.1.1	G												
			Custom Graphics	2.1.1	G												
			SD-08 Manufacturer's Instructions Manufacturer's Instructions	3.2													
			SD-10 Operation and Maintenance Data														
			Protection, Maintenance, and Repair Information	3.2													
		12 50 00.13 10	SD-01 Preconstruction Submittals														

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		12 50 00.13 10	Storage Location	1.7.3	G												
			SD-02 Shop Drawings														
			Installation Drawings	3.3.1	G												
			Grommet[, Power and	3.3.1	G												
			Communication Units][, and Wire														
			Management] Locations														
			SD-03 Product Data														
			Product Data	2.3	G												
			Product Style Options	2.3	G												
			SD-04 Samples														
			Fabric and Finishes	2.3.6	G												
			SD-07 Certificates														
			Authorized Dealer	1.6	G												
			Certified Furniture Installers	1.6	G												
			Licensed Electrician	1.6	G												
			Certified Telecommunications	1.6	G												
			Installer														
			Manufacturer's Certification	2.3	G												
			Warranty	1.8	G												
			SD-10 Operation and Maintenance														
			Data														
			Furniture, Data Package 1	3.5	G												
			SD-11 Closeout Submittals														
			Energy Efficient Equipment	2.1.1	S												
			Reduced VOC's for Furniture	2.1.2	S												
			Recycled Content of Furniture	2.1.3	S												

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																		(g)
		12 50 00.13 10	Bio-Based Content of Furniture	2.1.4	S													
		12 61 13	SD-02 Shop Drawings															
			Detailed Drawings	3.3	G													
			SD-03 Product Data															
			Seating System	1.3.2.1	G													
			Seating System	2.4	G													
			Recycled Content for upholstered audience seating	2.1	S													
			No added Urea-formaldehyde for Composite Wood or Agrifiber Products	2.3.5	S													
			SD-04 Samples															
			Seating System	1.3.2.1	G													
			Seating System	2.4	G													
			SD-06 Test Reports															
			Fire Test Response Characteristics	2.2.1	G													
			Double Rub Tests	2.3.1	G													
			SD-07 Certificates															
			Installer's Qualifications	1.3.3														
			Certified Sustainably Harvested plywood	2.3.3	S													
			Certified Sustainably Harvested solid hardwood and wood veneer	2.3.4	S													
			Indoor Air Quality for upholstered audience seating	2.1	S													

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		12 61 13	Indoor Air Quality for fabrics	2.3.1	S												
			Indoor Air Quality for composite wood and agrifiber products	2.3.5	S												
			SD-10 Operation and Maintenance Data														
			Assembly Manuals	2.4	G												
			SD-11 Closeout Submittals														
			Seating System	1.3.2.1	G												
			Seating System	2.4	G												
		13 34 19	SD-01 Preconstruction Submittals														
			Manufacturer's Qualifications	1.6.3	G												
			SD-02 Shop Drawings														
			Detail Drawings	1.6.1	G												
			Erection Plan	1.2.11	G												
			SD-03 Product Data														
			Manufacturer's Catalog Data	1.6.1	G												
			Recycled Content for Structural Steel Shapes and Plates	2.1.1	S												
			Recycled Content for Steel Pipe	2.1.2	S												
			Recycled Content for Aluminum Sheet Materials	2.4.1	S												
			Recycled Content for Steel Sheet Materials	2.4.2	S												
			Recycled Content for Insulation Materials	2.8.3	S												
			SD-04 Samples														



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		13 34 19	Coil Stock	2.1.6	G												
			Roof Panels	1.6.1	G												
			Wall Panels	1.6.1	G												
			Fasteners	2.5.2	G												
			Metal Closure Strips	2.8.1	G												
			Insulation	2.4.3	G												
			Vapor Barrier	1.6.10	G												
			Manufacturer's Color Charts and Chips	2.4.5	G												
			SD-05 Design Data														
			Manufacturer's Descriptive and Technical Literature	1.6.1	G												
			Manufacturer's Building Design Analysis	1.6.1	G												
			Lateral Force Calculations	1.6.1	G												
			SD-06 Test Reports														
			Test Reports	1.6.1	G												
			Coatings and Base Metals	1.6.1	G												
			Factory Color Finish Performance Requirements	1.6.1	G												
			SD-07 Certificates														
			System Components	1.6.1	G												
			Coil Stock Certificates	1.6.1	G												
			Aluminized Steel Repair Paint	1.6.1	G												
			Galvanizing Repair Paint	1.6.1	G												
			Enamel Repair Paint	1.6.1	G												

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		13 34 19	Qualification of Manufacturer	1.6.1	G												
			Qualification of Erector	1.6.1	G												
			SD-08 Manufacturer's Instructions														
			Installation of Roof and Wall panels	1.6.2	G												
			Shipping, Handling, and Storage	1.7	G												
			SD-11 Closeout Submittals														
			Manufacturer's Warranty	3.14.1	G												
			Contractor's Warranty for Installation	3.14.2	G												
		13 49 20.00 10	SD-02 Shop Drawings														
			Installation	3.2	G												
			Approved Drawings	2.6.1.6	G												
			SD-03 Product Data														
			EM Shielding System	3.2.1	G												
			Installation	3.2	G												
			Quality Control Plan	3.7	G												
			Qualifications	1.3.1	G												
			Qualifications of Welders	1.3.2	G												
			EM Door	3.9.5.1	G												
			Filter Assemblies	2.7.4	G												
			Penetrations	2.4.6	G												
			SD-06 Test Reports														
			Impulse Sparkover Voltage	2.8.1.3													
			ESA Extinguishing Test	2.8.1.4													

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		13 49 20.00 10	ESA Extreme Duty Discharge Test	2.8.1.5													
			Field Testing	3.9.2													
			SD-07 Certificates														
			Qualifications of Welders	1.3.2													
			SD-10 Operation and Maintenance Data														
			Operating and Maintenance Manuals	1.6.3	G												
			Service Organization	2.2.1	G												

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## SECTION 01 33 29

## SUSTAINABILITY REQUIREMENTS AND REPORTING

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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)

**HPSB Guiding Principles** (2016) Guiding Principles for Sustainable Federal Buildings and Determining Compliance with the Guiding Principles for Sustainable Federal Buildings

INTERNATIONAL CODE COUNCIL (ICC)

**ICC IgCC** (2018) International Green Construction Code

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

**ANSI/SMACNA 008** (2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. DEPARTMENT OF AGRICULTURE (USDA)

**FSRIA 9002** Farm Security and Rural Investment Act Section 9002 (USDA BioPreferred Program)

U.S. DEPARTMENT OF DEFENSE (DOD)

**UFC 1-200-02** (2020; with Change 1, 2020) High Performance and Sustainable Building Requirements

**UFC 3-600-01** (2016; with Change 6, 2021) Fire Protection Engineering for Facilities

U.S. DEPARTMENT OF ENERGY (DOE)

**Energy Star** (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**40 CFR 247** Comprehensive Procurement Guideline for Products Containing Recovered Materials

## 1.2 SUMMARY

This section includes requirements for Sustainability documentation and

reporting submittals per the federally mandated High Performance and Sustainable Building (HPSB) or HPSB "Guiding Principles" (GP), in accordance with **UFC 1-200-02** High Performance and Sustainable Building Requirements, and other identified requirements.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section **01 33 00** SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Sustainability Action Plan; G

#### SD-06 Test Reports

#### SD-11 Closeout Submittals

Final High Performance and Sustainable Building Checklist; G

Final Sustainability eNotebook; G

### 1.4 GUIDING PRINCIPLES VALIDATION (GPV)

Provide the following sustainability activities and documentation to verify achievement of **HPSB Guiding Principles** Validation (GPV):

- a. Analysis of each Guiding Principle Requirement and how project complies. Include final government approved narrative(s) in the HPSB Checklist submittal. Multiple checklists indicate multiple buildings that require individual HPSB Checklist tracking.
- b. No changes to the HPSB Checklist are allowed without approval from the Contracting Officer, in accordance with Section **01 33 00** SUBMITTAL REQUIREMENTS. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved **HPSB Guiding Principles** Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.
- c. Documentation of all work required to incorporate the applicable **HPSB Guiding Principles** requirements indicated on the HPSB Checklist and in this contract, including all "S" submittals.
- d. Sustainability Action Plan.
  - (1) HPSB Checklist(s)
  - (2) Sustainability Action Plan
  - (3) Documentation illustrating **HPSB Guiding Principles** Requirements compliance, including "S" submittals

#### 1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

- a. Analysis of each **HPSB Guiding Principles** Requirement and how project will comply. Final government approved narrative(s) must be included in the HPSB Checklist submittal.
- b. Name and contact information for: Contractor's Point of Contact (POC) ensuring sustainability goals are accomplished and documentation is assembled. For TPC that include on-site visit by third party representative, provide list of required attendees.
- c. Indoor Air Quality plan.

#### 1.4.2 Calculations

### 1.5 SUSTAINABILITY SUBMITTALS

Provide HPSB Checklist and other documentation in the Sustainability eNotebook to indicate compliance with the sustainability requirements of the project.

#### 1.5.1 High Performance Sustainable Building (HPSB) Checklist

Provide construction documentation that provides proof of, and supports compliance with, the completed HPSB Checklist.

##### 1.5.1.1 HPSB Checklist Submittals

Submit updated HPSB Checklist with each Sustainability eNotebook submittal. Include the final HPSB Checklist(s) with the interim DD1354 Real Property Record Submittal.

#### 1.5.2 "S" Submittals for Sustainability Documentation

"S" submittals are the sustainability documentation requirements cited in the various sections of this contract. Submit the GPV sustainability documentation required in this section as "S" submittals in all affected UFGS Sections.

- a. Highlight GPV compliance data in "S" submittal.
- b. Add "S" submittals to the Sustainability eNotebook only after submittal approval, and bookmark them as required in paragraph SUSTAINABILITY ENOTEBOOK below.
- c. Ensure all approved "S" submittals are included in each Sustainability eNotebook submittal.

#### 1.5.3 Sustainability eNotebook

The Sustainability eNotebook is an electronic organizational file that serves as a repository for all required sustainability submittals. To support documentation of compliance with an approved HPSB checklist, provide and maintain a comprehensive and current Sustainability eNotebook. Include all required data in Sustainability eNotebook, to support full compliance with the **HPSB Guiding Principles** Requirements, including:

- a. HPSB checklist
- b. Sustainability Action Plan

- c. Calculations
- d. Labels
- e. "S" submittals

#### 1.5.3.1 Sustainability eNotebook Format

Provide Sustainability eNotebook in the form of an Adobe PDF file; bookmark each **HPSB Guiding Principles** Requirement and sub-bookmark at each document. Match format to **HPSB Guiding Principles** numbering system indicated herein. Maintain up-to-date information, such as spreadsheets, templates, with each current submittals.

Contracting Officer may deduct from the monthly progress payment accordingly if Sustainability eNotebook information is not current and on track per project goals.

#### 1.5.3.2 Sustainability eNotebook Submittal Schedule

Provide Sustainability eNotebook Submittals at the following milestones of the project:

- e. Construction Quality Control Meetings.

Provide up-to-date GP documentation in the Sustainability eNotebook for each meeting.

- f. **Final Sustainability eNotebook**

Submit updated Sustainability eNotebook with updated **Final High Performance and Sustainable Building Checklist** at Beneficial Occupancy Date (BOD). Final progress payment retainage may be held by Contracting Officer until Final Sustainability construction phase documentation is complete.

### 1.6 DOCUMENTATION REQUIREMENTS

- a. Incorporate each of the following **HPSB Guiding Principles** requirements into project and provide documentation that proves compliance with each listed requirement. Items below are organized by **HPSB Guiding Principles**. For life-cycle cost analysis requirements, one document with all analyses is acceptable, with Contracting Officer approval.
- b. For each of the following paragraphs that require the use of products listed on Government-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.

#### 1.6.1 Commissioning (Cx)

Develop and incorporate Commissioning requirements into the documents, in accordance with Section **01 91 00.15 10** TOTAL BUILDING COMMISSIONING.

#### 1.6.2 Energy Efficient Products



Provide only energy-using products that are **Energy Star** rated or have Federal Energy Management Program (FEMP) recommended efficiency. Where **Energy Star** or FEMP recommendations have not been established, provide most efficient products that are life-cycle cost-effective. Provide only energy using products that meet FEMP requirements for low standby power consumption. Energy efficient products can be found at: <https://www.energy.gov/eere/femp/federal-energy-management-program> and <http://www.energystar.gov/>.

For construction submittal documentation, provide proof that product is labeled energy efficient and complies with the cited requirements.

### 1.6.3 Building-level Power Metering

Provide building-level meters for electricity, natural gas, and steam where applicable.

#### 1.6.3.1 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.4 Indoor Water Use

Provide Construction Documentation proof that fixtures are labeled EPA WaterSense, for products available with EPA WaterSense labeling; for all other fixtures, proof they comply with EPA WaterSense efficiency requirements.

### 1.6.5 Indoor Water Metering

Provide building-level meters for potable water use. Provide the requirements cited in the following paragraphs:

#### 1.6.5.1 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.6 Outdoor Water Use

Where new irrigation is required, provide only non-potable sources. Provide the requirements cited in the following paragraphs:

#### 1.6.6.1 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.7 Outdoor Water Meters

Provide meters for outdoor systems that use potable water. Provide the requirements cited in the following paragraphs:

#### 1.6.7.1 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.8 Moisture Control

Provide the following:

#### 1.6.8.1 Construction Submittal Documentation

Ensure construction materials are separated and protected in accordance with other sections in this contract document, with adequate humidity controls during construction. In accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, includes plan for ongoing building moisture control.

### 1.6.9 Reduce Volatile Organic Compounds (VOC) (Low-Emitting Materials)

Meet the requirements of Table 3-1 at the end of this specification.

For Construction submittal documentation, provide certifications or labels that demonstrate compliance with cited requirements, based on the attached TABLE 3-1.

### 1.6.10 Indoor Air Quality During Construction

Prior to construction, create indoor air quality plan. Develop and implement an IAQ construction management plan during construction and flush building air before occupancy.

For new construction and for renovation of unoccupied existing buildings, meet the requirements of ICC IgCC 1001.3.1.5 (10.3.1.4) Indoor Air Quality (IAQ) Construction Management. For renovation of occupied existing buildings, meet the requirements of ANSI/SMACNA 008 IAQ Guidelines for Occupied Buildings Under Construction.

Provide documentation showing that after construction ends and prior to occupancy, HVAC filters were replaced and area air was flushed out in accordance with the cited standard.

### 1.6.11 Recycled Content

Comply with 40 CFR 247. Refer to: <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program> for assistance identifying products cited in 40 CFR 247. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements.

#### 1.6.11.1 Construction Submittal Documentation

- a. Provide manufacturers' documents stating the recycled content by material, or written justification for claiming one of the exceptions allowed on the cited website.
- b. Substitutions: Submit for Government approval for proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. For all such proposed substitutions, submit with the Sustainability Action Plan accompanied by product data demonstrating equivalence.
- c. In order to complete compliance with FAR 52.223-9 Estimate of

Percentage of Recovered Material Content for EPA Designated Items, refer to submittal requirement for recycled/recovered material content in Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.12 Bio-Based Products

Provide products and materials composed of the highest percentage of bio-based materials (including rapidly renewable resources and certified sustainably harvested products), consistent with FSRIA 9002 USDA BioPreferred Program, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user and when available at a reasonable cost. Use only supplies and materials of a type and quality that conform to applicable specifications and standards.

Comply with FSRIA 9002 USDA BioPreferred Program. Refer to [www.biopreferred.gov](http://www.biopreferred.gov) for the product categories and BioPreferred Catalog. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements. Provide the following documentation:

- a. USDA BioPreferred label for each product; for bio-based products used on project but not listed with BioPreferred program, provide bio-based content and percentage.
- b. In order to complete compliance with FAR 52.223-1 Biobased Product Certification, refer to submittal requirement for biobased products in Section 01 78 00 CLOSEOUT SUBMITTALS, paragraphs CERTIFICATION OF EPA DESIGNATED ITEMS and CERTIFICATION OF USDA DESIGNATED ITEMS.

#### 1.6.13 Waste Material Management (Recycling - Construction)

Divert demolition and construction debris in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

### PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

#### 3.1 SUSTAINABILITY COORDINATION

Provide sustainability focus and coordination at all meetings to achieve sustainability goals. Coordinate meeting requirements with other UFGS Sections meeting requirements in this project. Ensure the designated sustainability professional responsible for GP documentation participates in these meetings to coordinate documentation completion. Review GP sustainability requirements, HPSB Checklist documentation, Sustainability Action Plan, and completeness status of Sustainability eNotebook at the following meetings:

- a. Pre-Construction Conference
- b. Construction Quality Control Meetings
- g. Facility Turnover Meetings

Conduct review no later than 60 days before final turnover and identify

any outstanding issues that affect correct completion of all documentation, and actions that will achieve requirements. Conduct corrective actions prior to turnover, to ensure all requirements are achieved.

3.2 TABLE 3-1 VOLATILE ORGANIC COMPOUNDS (VOC) (LOW EMITTING MATERIALS) REQUIREMENTS

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Adhesives and Sealants	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Adhesives (carpet, resilient, wood flooring; base cove; ceramic tile; drywall and panel; primers) Sealants (acoustical; firestop; HVAC Air duct; primers) Caulks	SCAQMD Rule 1168 (Use "other" category for HVAC duct sealant) (for firestop adhesive, <b>UFC 3-600-01</b> overrides conflicting requirements)
			Aerosol adhesives	Section 3 of Green Seal Standard GS-36 (except: cleaners, solvent cements, and primers used with plastic piping and conduit in plumbing, fire suppression, and electrical systems; HVAC air duct sealants when the application space air temp is less than 40 F (4.5 C).

**TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements**  
 Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Paints and Coatings	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Flat and nonflat, nonflat high-gloss, specialty, basement specialty, fire-resistive, floor, low-solids, rust preventative, wood, reflective wall coatings; concrete/masonry sealers; primers; sealers; undercoaters; shellacs (clear and opaque); stains; varnishes; conjugated oil varnish; lacquer; clear brushing lacquer	Green Seal Standard GS-11

<b>TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements</b>				
Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)				
<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
<b>Paints and Coatings</b>	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Concrete curing compounds; dry fog, faux finishing, graphic arts (sign paints), industrial maintenance, mastic texture, metallic pigmented, multicolor, recycled coatings; pretreatment wash primers, reactive penetrating sealers; specialty primers, wood preservatives, and zinc primers	California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings or SCAQMD Rule 1113r
<b>Paints and Coatings</b>	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	High-temperature coatings; stone consolidants; swimming-pool coatings; tub-and tile-refining coatings; and waterproofing membranes	California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings

<b>TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements</b>				
Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)				
<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
<b>Floor Covering Materials</b>	For carpet, all locations: CDPH/EHLB/Standard Method V1.1 (California Section 01350) or label for Section 9 of CDPH/EHLB/Standard Method V1.1 (California Section 01350)		none	none
<b>Insulation</b>	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)		none	none

**TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements**  
 Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
<p><b>Composite Wood, Wood Structural Panel, and Agrifiber Products</b>, no added urea-formaldehyde resins including laminating adhesives for composite wood and agrifiber assemblies - particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, door cores</p>	<p>Third-party certification (approved by CARB) of <b>California Air Resource Board's (CARB) regulation</b> Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products</p>	<p>or</p>	<p>none</p>	<p><b>CDPH/EHLB/Standard method V1.1</b> (California Section 01350) (Use "office" or "classroom" space limits for all applications) (except: Structural panel components such as plywood, particle board, wafer board, and oriented strand board identified as "EXPOSURE 1," "EXTERIOR," or "HUD-APPROVED" are considered acceptable for interior use)</p>
<p><b>Office Furniture Systems and Seating</b> installed prior to occupancy</p>	<p><b>ANSI/BIFMA X7.1</b>  <b>ANSI/BIFMA X7.1:</b> (95-percent of installed office furniture system workstations and seating units)   <b>Section 7.6.2 of ANSI/BIFMA e3</b> (50-percent of office furniture system workstations and seating units)</p>		<p>none</p>	<p>none</p>



<b>TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements</b>				
Source: ICC IgCC Chapter 8 (Materials) (Interior Applications Only)				
<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
Ceiling and Wall assemblies and systems including: acoustical treatments; ceiling panels and tiles; tackable wall panels and coverings; wall coverings; wall and ceiling paneling and planking	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)		none	none

-- End of Section --

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## SECTION 01 35 13

## SPECIAL PROJECT PROCEDURES

11/20, CHG 1: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## U.S. Code (USC)

49 USC 44718 Structures Interfering with Air Commerce or National Security

49 USC 46301 Civil Penalties

## U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (2016; Rev L; Change 2) Obstruction Marking and Lighting

FAA AC 150/5300-13 (2020; Rev B) Airport Design

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

14 CFR 77 Safe, Efficient Use, and Preservation of the Navigable Airspace

## 1.2 DEFINITIONS

## 1.2.1 Landing Areas

"Landing Areas" means:

- a. The primary surfaces, comprising the surface of the runway, runway shoulders, and lateral safety zones. The length of each primary surface is the same as the runway length. The width of each primary surface is 2000 feet ( 1000 feet on each side of the runway centerline).
- b. The "clear zone" beyond the ends of each runway is the extension of the primary surface for a distance of 3000 feet in length for fixed wing aircraft and 400 feet in length for helicopter only runways beyond each end of each runway.
- c. All taxiways, plus the lateral clearance zones along each side for the length of the taxiways (the outer edge of each lateral clearance zone is laterally 250 feet from the far or opposite edge of the taxiway (example: a 75 foot wide taxiway must have a combined width and lateral clearance zone of 425 feet.)
- d. All aircraft parking aprons, plus the area 125 feet in width extending beyond each edge around the aprons.

## 1.2.2 Safety Precaution Areas

"Safety Precaution Areas" means those portions of approach-departure clearance zones and transitional zones where placement of objects incident to Contract performance might result in vertical projections at or above the approach-departure clearance, or the transitional surface.

- a. The "approach-departure clearance surface" is an extension of the primary surface and the clear zone at each end of each runway, for a distance of 50,000 feet, first along an inclined (glide angle) and then along a horizontal plane, both flaring symmetrically about the runway centerline extended.
  - (1) The inclined plane (glide angle) begins in the clear zone 200 feet past the end of the runway (and primary surface) at the same elevation as the end of the runway. It continues upward at a slope of 50:1 ( one foot vertically for each 50 feet horizontally) to an elevation of 500 feet above the established airfield elevation. At that point the plane becomes horizontal, continuing at that same uniform elevation to a point 50,000 feet longitudinally from the beginning of the inclined plane (glide angle) and ending there.
  - (2) The width of the surface at the beginning of the inclined plane (glide angle) is the same as the width of the clear zone. It then flares uniformly, reaching the maximum width of 16,000 feet at the end.
- b. The "approach-departure clearance zone" is the ground area under the approach-departure clearance surface.
- c. The "transitional surface" is a sideways extension of all primary surfaces, clear zones, and approach-departure clearance surfaces along inclined planes.
  - (1) The inclined plane in each case begins at the edge of the surface.
  - (2) The slope of the incline plane is 7:1 ( one foot vertically for each 7 feet horizontally). It continues to the point of intersection with the:
    - (a) Inner horizontal surface (which is the horizontal plane 150 feet above the established airfield elevation); or
    - (b) Outer horizontal surface (which is the horizontal plane 500 feet above the established airfield elevation), whichever is applicable.
- d. The "transitional zone" is the ground area under the transitional surface. (It adjoins the primary surface, clear zone, and approach-departure clearance zone.)

### 1.2.3 Federal Aviation Administration (FAA) Notice of Proposed Construction or Alteration

- a. FAA Notice of Proposed Construction or Alteration may be required in accordance with 49 USC 44718 and 14 CFR 77, depending on height of construction equipment on site, height of temporary structures, proximity to an airport or heliport, and specific location of equipment or temporary structure. For the purpose of notifying the FAA, proximity

shall be defined as within 5 nautical miles of a Government or civilian airfield, including landing areas, taxiways, runways and helicopter pads.

- b. In order to determine if a FAA Notice of Proposed Construction or Alteration is required, refer to 14 CFR 77 Subpart B. Alternately, utilize the FAA's Notice Criteria Tool located at: <https://oeaaa.faa.gov/oeaaa/external/portal.jsp>. The FAA will determine if the equipment or temporary structure exceeds obstruction standards and may pose a hazard to air navigation.
- c. Failure to comply with the provisions of 14 CFR 77 are subject to Civil Penalty under Section 902 of the Federal Aviation Act of 1958, as amended and pursuant to 49 USC 46301 Subpart (a).

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

##### Heavy Equipment and Vehicle List

FAA Form 7460-1

FAA Form 7460-2

##### Construction Operations Plan

## PART 2 PRODUCTS

### 2.1 AIRFIELD OBSTRUCTION LIGHTS

Airfield obstruction lights must be in accordance with FAA AC 70/7460-1 and have red or white lenses.

## PART 3 EXECUTION

### 3.1 HAZARDS TO AIRFIELD OPERATION

In addition to DFARS 252.236-7005 Airfield Safety Precautions, the following paragraphs apply.

#### 3.1.1 Work in Proximity to Landing Areas

Place nothing upon the landing area or applicable portions of safety precaution areas without authority of the Contracting Officer.

Use of landing areas for purposes other than aircraft operation, is prohibited without permission of the Contracting Officer, and the landing area/landing strip/landing pad is closed by order of the Contracting Officer and marked as indicated herein.

Accomplish all construction work on the runways, taxiways, and parking aprons and in the end zones of the runways and 75 feet to each side of the runways and taxiways with extreme care regarding the operation of

aircraft. Cooperate closely, and coordinate with the **Airfield** Operations Officer and the Contracting Officer. Park equipment in an area designated by the Contracting Officer. Parking of equipment, vehicles, or any storage features overnight or for any extended period of time in the proximity of the landing areas or taxiways is strictly prohibited. Leave no material in areas where extreme care is to be taken regarding the operation of aircraft.

During periods of active performance of work on the airfield by the Contractor, govern all operations of mobile equipment in accordance with the safety provisions.

### 3.1.2 Contractor FAA Notification

When required in accordance with **49 USC 44718** and **14 CFR 77**, submit **FAA Form 7460-1** and attachments directly to the FAA a minimum of 60 calendar days prior to the start date of the operations that may affect air traffic. Submit supplemental notification **FAA Form 7460-2** to the FAA within 48 hours prior to start of the construction. Simultaneous with submission to the FAA, submit both forms to the Contracting Officer for information. It is the Contractor's responsibility to notify the FAA when required.

### 3.1.3 Schedule of Work/Aircraft Operating Schedules

Schedule work to conform to aircraft operating schedules. The Government will exert every effort to schedule aircraft operations so as to permit the maximum amount of time for the Contractor's activities; however, in the event of emergency, intense operational demands, adverse wind conditions, and other such unforeseen difficulties, the Contractor must cease operations at the specified locations in the aircraft operational area for the safety of the Contractor and military personnel and Government property. Submit a schedule of the work to the Contracting Officer for transmittal to the **Airfield** Operations Officer describing the work to be accomplished; the location of the work, noting distances from the ends of landing areas, taxiways and buildings and other structures as necessary; and dates and hours during which the work is to be accomplished. Keep the approved schedule of work current, and notify the Contracting Officer of changes prior to beginning each day's work.

Where flying is controlled, obtain permission from the control tower operator to enter a landing area unless such area is marked as hazardous to aircraft.

#### 3.1.3.1 Construction Operations Plan

Submit a **Construction Operations Plan** prior to the start of work that includes a description of the airfield work to be accomplished; the exact location of the work, noting distances from the ends of landing areas, taxiways and buildings and other structures as necessary; and dates and hours during which the work is to be accomplished. Keep the approved schedule of work current and notify the Contracting Officer of changes prior to beginning each day's work.

#### 3.1.4 Daytime Markings

During daylight, mark stationary and mobile equipment with international orange and white checkered flags, mark the material, and work with yellow flags.

Submit a [Heavy Equipment and Vehicle List](#) identifying all stationary and mobile equipment and vehicles that will be operating on the airfield. All equipment and vehicles must be identified by means of a flag on a staff attached to and flying above the vehicle. Flag size must be not less than [3 feet](#) square and consist of a checkered pattern of international orange and white squares not less than [one foot](#) on each side. Flags varying in any dimension by not more than 10 percent of the specified dimensions are considered to comply with the stated requirements.

#### 3.1.5 Nighttime Markings

During nighttime, which begins 2-hours before sundown and ends 2-hours after sunrise, mark stationary and mobile equipment and material, and work with battery-operated, low-intensity, red flasher lights. Where the [Airfield Operations Officer](#) determines that the red flasher lights may confuse pilots approaching for landings, the [Airfield Operations Officer](#) may direct that the red flasher lights be left off or that the color of the lights be changed.

Provide lighting in accordance with [FAA AC 70/7460-1](#). Provide a minimum of two aviation red or high intensity white obstruction lights on temporary structures (including cranes) over [100 feet](#) above ground level. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

No separate payments will be made for lighting and protection necessitated by the safety provisions.

#### 3.1.6 Excavation

Open only those trenches for which material is on hand and ready for placing therein. As soon as possible after the material has been placed and work approved, backfill and compact the trenches as specified.

Maintain landing areas at all times free from hazards, holes, material piles, or projecting shoulders that might damage tires or landing gear. Keep paved surfaces clean at all times and free from small stones or other objects which could cause damage to propellers, craft, and personnel.

#### 3.1.7 Contractor Safety Precautions

The Contractor is advised that aircraft operations will produce extremely high noise levels and will induce vibrations in pavements, structures, and equipment in the vicinity, and may result in high velocity flying debris in the area. These anticipated hazards must be appropriately addressed in the Activity Hazard Analysis (AHA) associated with airfield work - the Activity Hazard Analysis must be in accordance with Section [01 35 26](#) GOVERNMENTAL SAFETY REQUIREMENTS. The Contractor is responsible for providing personal protective equipment (PPE) and other safety devices required to ensure protection of contractor personnel and equipment. Schedule the work to eliminate hazards to personnel and equipment and to prevent damage to work performed.

Boundary areas for hazardous work locations and restrictions are defined in [FAA AC 150/5300-13](#). Construction activity within the limits of the boundary areas without approval of the Contracting Officer is prohibited.

#### 3.1.8 Base Civil Engineering (BCE) Work Clearance Request

Obtain an approved BCE Work Clearance Request, AF Form 103, prior to the start of excavation, digging work, or work that disrupts aircraft or vehicular traffic flow, base utility services, fire and intrusion alarm system, or routine activities of the Activity.

#### 3.1.9 Radio Contact

Provide necessary battery powered portable radios, including one radio for the tower. During work within the landing area, have an operator (who speaks fluent English) available for radio contact with the tower at all times. Obtain approval of radio frequency from the tower.

-- End of Section --



## SECTION 01 35 26

## GOVERNMENTAL SAFETY REQUIREMENTS

11/20, CHG 3: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.3	(2020) Tower Cranes
ASME B30.5	(2021) Mobile and Locomotive Cranes
ASME B30.7	(2021) Winches
ASME B30.8	(2020) Floating Cranes and Floating Derricks
ASME B30.9	(2018) Slings
ASME B30.20	(2018) Below-the-Hook Lifting Devices
ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.23	(2016) Personnel Lifting Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
ASME B30.26	(2015; R 2020) Rigging Hardware

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.22	(2007; R 2017) Safety Requirements for Rope-Guided and Non-Guided Workers' Hoists
ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ASSP A10.44	(2020) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSP Z244.1	(2016) The Control of Hazardous Energy Lockout, Tagout and Alternative Methods
ASSP Z359.0	(2018) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSP Z359.1	(2020) The Fall Protection Code
ASSP Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection

## Program

- ASSP Z359.3 (2019) Safety Requirements for Lanyards and Positioning Lanyards
- ASSP Z359.4 (2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
- ASSP Z359.6 (2016) Specifications and Design Requirements for Active Fall Protection Systems
- ASSP Z359.7 (2019) Qualification and Verification Testing of Fall Protection Products
- ASSP Z359.11 (2014) Safety Requirements for Full Body Harnesses
- ASSP Z359.12 (2019) Connecting Components for Personal Fall Arrest Systems
- ASSP Z359.13 (2013) Personal Energy Absorbers and Energy Absorbing Lanyards
- ASSP Z359.14 (2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
- ASSP Z359.15 (2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
- ASSP Z359.16 (2016) Safety Requirements for Climbing Ladder Fall Arrest Systems
- ASSP Z359.18 (2017) Safety Requirements for Anchorage Connectors for Active Fall Protection Systems

## ASTM INTERNATIONAL (ASTM)

- ASTM F855 (2019) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 1048 (2016) Guide for Protective Grounding of Power Lines
- IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 10 (2022; ERTA 1 2021) Standard for Portable Fire Extinguishers

NFPA 51B	(2019; TIA 20-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 70E	(2021) Standard for Electrical Safety in the Workplace
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

## TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-222	(2018H; Add 1 2019) Structural Standard for Antenna Supporting Structures and Antennas and Small Wind Turbine Support Structures
TIA-1019	(2012; R 2016) Standard for Installation, Alteration and Maintenance of Antenna Supporting Structures and Antennas

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual
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## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.333	Selection and Use of Work Practices
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1915.89	Control of Hazardous Energy (Lockout/Tags-Plus)
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.16	Rules of Construction
29 CFR 1926.450	Scaffolds

29 CFR 1926.500	Fall Protection
29 CFR 1926.552	Material Hoists, Personal Hoists, and Elevators
29 CFR 1926.553	Base-Mounted Drum Hoists
29 CFR 1926.1400	Cranes and Derricks in Construction
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
CPL 02-01-056	(2014) Inspection Procedures for Accessing Communication Towers by Hoist
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

## 1.2 DEFINITIONS

### 1.2.1 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures with regards to such hazards.

### 1.2.2 Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person requirements, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.4 Competent Person, Excavation/Trenching

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential

hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSP Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.6 Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented including experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

#### 1.2.7 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the training material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

#### 1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

#### 1.2.9 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

#### 1.2.10 Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting

equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

#### 1.2.11 Medical Treatment

Medical Treatment is treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even when provided by a physician or registered personnel.

#### 1.2.12 Near Miss

A Near Miss is a mishap resulting in no personal injury and zero property damage, but given a shift in time or position, damage or injury may have occurred (e.g., a worker falls off a scaffold and is not injured; a crane swings around to move the load and narrowly misses a parked vehicle).

#### 1.2.13 Operating Envelope

The Operating Envelope is the area surrounding any crane or load handling equipment. Inside this "envelope" is the crane, the operator, riggers and crane walkers, other personnel involved in the operation, rigging gear between the hook, the load, the crane's supporting structure (i.e. ground or rail), the load's rigging path, the lift and rigging procedure.

#### 1.2.14 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

#### 1.2.15 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the definition requirements of [EM 385-1-1](#) Appendix Q, and [ASSP Z359.2](#) standard, having a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

#### 1.2.16 Recordable Injuries or Illnesses

Recordable Injuries or Illnesses are any work-related injury or illness that results in:

- a. Death, regardless of the time between the injury and death, or the length of the illness;
- b. Days away from work (any time lost after day of injury/illness onset);
- c. Restricted work;
- d. Transfer to another job;
- e. Medical treatment beyond first aid;

- f. Loss of consciousness; or
- g. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (f) above

#### 1.2.17 Government Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

#### 1.2.18 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document an LHE mishap using the Crane High Hazard working group mishap reporting form.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

APP - Construction; G

Dive Operations Plan; G

Accident Prevention Plan (APP); G

#### SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G

LHE Inspection Reports

#### SD-07 Certificates

Crane Operators/Riggers

Standard Lift Plan; G

Critical Lift Plan ; G

Naval Architecture Analysis; G

Activity Hazard Analysis (AHA)

Confined Space Entry Permit

Hot Work Permit

Certificate of Compliance

License Certificates

Radiography Operation Planning Work Sheet; G

Portable Gauge Operations Planning Worksheet; G

#### 1.4 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher.

#### 1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this Contract, comply with the most recent edition of USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

#### 1.6 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

##### 1.6.1 Personnel Qualifications

##### 1.6.1.1 Site Safety and Health Officer (SSHO)

Provide an SSHO that meets the requirements of EM 385-1-1 Section 1. The SSHO must ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Alternate SSHO must be at the work site at all times to implement and administer the Contractor's safety program and Government-accepted Accident Prevention Plan. The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

If the SSHO is off-site for a period longer than 24 hours, an equally-qualified alternate SSHO must be provided and must fulfill the same roles and responsibilities as the primary SSHO. When the SSHO is temporarily (up to 24 hours) off-site, a Designated Representative (DR), as identified in the AHA may be used in lieu of an Alternate SSHO, and must be



on the project site at all times when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full time occupation.

#### 1.6.1.1.1 Additional Site Safety and Health Officer (SSHO) Requirements and Duties

The SSHO may also serve as the Quality Control Manager. The SSHO may also serve as the Superintendent **although not if already designated as Quality Control Manager.**

#### 1.6.1.2 Competent Person Qualifications

Provide Competent Persons in accordance with **EM 385-1-1**, Appendix Q and herein. Competent Persons for high risk activities include confined space, cranes and rigging, excavation/trenching, fall protection, and electrical work. The CP for these activities must be designated in writing, and meet the requirements for the specific activity (i.e. competent person, fall protection).

The Competent Person identified in the Contractor's Safety and Health Program and accepted Accident Prevention Plan, must be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the Contracting Officer for information in consultation with the Safety Office.

##### 1.6.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of **EM 385-1-1**, Appendix Q, and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with **EM 385-1-1**, Section 34.

##### 1.6.1.2.2 Competent Person for Scaffolding

Provide a Competent Person for Scaffolding who meets the requirements of **EM 385-1-1**, Section 22.B.02 and herein.

##### 1.6.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of **EM 385-1-1**, Section 21.C.04, 21.B.03, and herein.

#### 1.6.1.3 Qualified Trainer Requirements

Individuals qualified to instruct the 40 hour contract safety awareness course, or portions thereof, must meet the definition of a Competent Person Trainer, and, at a minimum, possess a working knowledge of the following subject areas: **EM 385-1-1**, Electrical Standards, Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with **29 CFR 1926.450**, Subpart L.

Instructors are required to:

- a. Prepare class presentations that cover construction-related safety requirements.

- b. Ensure that all attendees attend all sessions by using a class roster signed daily by each attendee. Maintain copies of the roster for at least five years. This is a certification class and must be attended 100 percent. In cases of emergency where an attendee cannot make it to a session, the attendee can make it up in another class session for the same subject.
- c. Update training course materials whenever an update of the EM 385-1-1 becomes available.
- d. Provide a written exam of at least 50 questions. Students are required to answer 80 percent correctly to pass.
- e. Request, review and incorporate student feedback into a continuous course improvement program.

#### 1.6.1.4 Dredging Contract Requirements

##### 1.6.1.4.1 Dredging Safety Personnel Requirements

- a. Provide a minimum of one SSHO assigned per project site for the primary working shift.
- b. For a project involving multiple work shifts, provide one full-time SSHO for each additional shift.
- c. For individual dredging projects or sites with a dredge crew and fill crew on watch of eight employees or less, a CDSO must be appointed, instead of an SSHO. The CDSO assumes the same responsibilities as a full-time SSHO.
- d. An example of one dredging project site is reflected in each of the following:
  - (1) a mechanical dredge, tug(s) and scow(s), scow route, and material placement site; or
  - (2) a hydraulic pipeline dredge, attendant plant, and material placement site; or,
  - (3) a hopper dredge (include land-based material placement site - if applicable.)
- e. For Hopper Dredges with the U.S. Coast Guard, documented crews may designate an officer as a Collateral Duty Safety Officer (CDSO) instead of having a full-time SSHO onboard if the officer meets the SSHO training and experience requirements.

##### 1.6.1.4.2 SSHO Requirements for Dredging

- a. In addition to requirements stated elsewhere in this specification, an individual serving as a SSHO must be present at the project site, located so that they have full mobility and reasonable access to all major work operations, for at least one shift in each 24 hour period when work is being performed. The SSHO must be available during their shift for immediate verbal consultation and notification, either by phone or radio.
- b. The SSHO is a full-time, dedicated position, except as noted above, who

must report to a senior project (or corporate) official. When the SSHO is permitted to be a collateral duty, the SSHO is not permitted to be in another position requiring continuous mechanical or equipment operations, such as equipment operators.

- c. The SSHO must inspect all work areas and operations during initial set-up and at least monthly observe and provide personal oversight on each shift during dredging operations for projects with many work sites, more often for those with less work sites.

#### 1.6.1.4.3 Collateral Duty Safety Officer (CDSO) Requirements for Dredging

- a. A CDSO is an individual who is assigned collateral duty safety responsibilities in addition to their full-time occupation, and who supports and supplements the SSHO efforts in managing, implementing and enforcing the Contractor's Safety and Health Program. The assigned CDSO must be an individual(s) with work oversight responsibilities, such as master, mate, fill foreman, or superintendent. A CDSO must not be an employee responsible for continuous mechanical or equipment operations, such as an equipment operator.
- b. A CDSO performs safety program tasks as assigned by the SSHO and must report safety findings to the SSHO. The SSHO must document results of safety findings and provide information for inclusion in the CQC reports to the Contracting Officer.

#### 1.6.1.4.4 Safety Personnel Training Requirements for Dredging

A SSHO and a CDSO for dredging Contracts must take either a formal classroom or online OSHA 30-hour Construction Safety Course, or an equivalent 30 hours of formal classroom or online safety and health training covering the subjects of the OSHA 30-hour Course in accordance with EM 385-1-1 Appendix A, paragraph 3.d.(3), applicable to dredging work, and given by qualified instructors. In exception to EM 385-1-1, Section 01.A.17, comply with the following:

- a. The SSHO must maintain competency through having taken 8 hours of formal classroom or online safety and health related coursework every year. Hours spent as an instructor in such courses will be considered the same as attending them, but each course only gets credit once (for example, instructing a 1-hour asbestos awareness course five times in a year provides one hour credit for training).
- b. The SSHO and a CDSO must have a minimum of three years of experience within the past five years in one of the following:
  - (1) Supervising/managing dredging activities
  - (2) Supervising/managing marine construction activities
  - (3) Supervising/managing land-based construction activities
  - (4) Work managing safety programs or processes
  - (5) Conducting hazard analyses and developing controls in activities or environments with similar hazards

#### 1.6.1.5 Crane Operators/Riggers

Provide Operators, Signal Persons, and Riggers meeting the requirements in [EM 385-1-1](#), Section 15.B for Riggers and Section 16.B for Crane Operators and Signal Persons. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a Government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification.

#### 1.6.2 Personnel Duties

##### 1.6.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO must:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
- b. Conduct mishap investigations and complete required accident reports. Report mishaps and near misses.
- c. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer upon request. Post and maintain the Form 300A on the site Safety Bulletin Board.
- d. Maintain applicable safety reference material on the job site.
- e. Attend the pre-construction [conference](#), pre-work meetings including preparatory meetings, and periodic in-progress meetings.
- f. Review the APP and AHAs for compliance with [EM 385-1-1](#), and approve, sign, implement and enforce them.
- g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.
- h. Ensure subcontractor compliance with safety and health requirements.
- i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).
- j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.
- k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

Superintendent, QC Manager, and SSHO are subject to dismissal if the above or any other required duties are not being effectively carried out. If either the Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

### 1.6.3 Meetings

#### 1.6.3.1 Preconstruction Conference

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction conference. This includes the project superintendent, Site Safety and Occupational Health Officer, quality control manager, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the Contract. This list of proposed AHAs will be reviewed and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays.
- c. Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin until an APP is established that is acceptable to the Contracting Officer.

#### 1.6.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors at the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

### 1.7 ACCIDENT PREVENTION PLAN (APP)

#### 1.7.1 APP - Construction

A qualified person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, Appendix A, and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their

subcontractors of the safety provisions under the terms of the Contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed by an officer of the firm (Prime Contractor senior person), the individual preparing the APP, the on-site superintendent, the designated SSHO, the Contractor Quality Control Manager, and any designated Certified Safety Professional (CSP) or Certified Health Physicist (CIH). The SSHO must provide and maintain the APP and a log of signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the Contract. Disregarding the provisions of this Contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the Contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and Quality Control Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e. imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSP A10.34), and the environment.

#### 1.7.2 Names and Qualifications

Provide plans in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

- a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.
- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

#### 1.7.3 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

#### 1.7.3.1 Confined Space Entry Plan

Develop a confined or enclosed space entry plan in accordance with EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this Contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by Contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

#### 1.7.3.2 Standard Lift Plan (SLP)

Plan lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP in accordance with EM 385-1-1, Section 16.A.03, using Form 16-2 for every lift or series of lifts (if duty cycle or routine lifts are being performed). The SLP must be developed, reviewed and accepted by all personnel involved in the lift in conjunction with the associated AHA. Signature on the AHA constitutes acceptance of the plan. Maintain the SLP on the LHE for the current lift(s) being made. Maintain historical SLPs for a minimum of three months.

#### 1.7.3.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. In addition, Critical Lift Plans are required for the following:

- a. Lifts over 50 percent of the capacity of barge mounted mobile crane's hoist.
- b. When working around energized power lines where the work will get closer than the minimum clearance distance in EM 385-1-1 Table 16-1.
- c. For lifts with anticipated binding conditions.
- d. When erecting cranes.

##### 1.7.3.3.1 Critical Lift Plan Planning and Schedule

Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

##### 1.7.3.3.2 Lifts of Personnel

In addition to the requirements of EM 385-1-1, Section 16.H.02, for lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.

#### 1.7.3.4 Barge Mounted Mobile Crane Lift Plan

Provide a Naval Architecture Analysis and include an LHE Manufacturer's Floating Service Load Chart in accordance with EM 385-1-1, Section 16.L.03.

#### 1.7.3.5 Multi-Purpose Machines, Material Handling Equipment, and

### Construction Equipment Lift Plan

Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Written approval from a qualified registered professional engineer, after a safety analysis is performed, is allowed in lieu of the OEM's approval. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

#### 1.7.3.6 Fall Protection and Prevention (FP&P) Plan

The plan must be in accordance with the requirements of EM 385-1-1, Section 21.D and ASSP Z359.2, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, roles and responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Review and revise, as necessary, the Fall Protection and Prevention Plan documentation as conditions change, but at a minimum every six months, for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Plan documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Plan documentation in the Accident Prevention Plan (APP).

#### 1.7.3.7 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSP Z359.2, and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

#### 1.7.3.8 Hazardous Energy Control Program (HECP)

Develop a HECP in accordance with EM 385-1-1 Section 12, 29 CFR 1910.147, 29 CFR 1910.333, 29 CFR 1915.89, ASSP Z244.1, and ASSP A10.44. Submit this HECP as part of the Accident Prevention Plan (APP). Conduct a preparatory meeting and inspection with all effected personnel to coordinate all HECP activities. Document this meeting and inspection in accordance with EM 385-1-1, Section 12.A.02. Ensure that each employee is familiar with and complies with these procedures.

#### 1.7.3.9 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A and Section 31 00 00 EARTHWORK.

#### 1.7.3.10 Lead, Cadmium, and Chromium Compliance Plan

Identify the safety and health aspects of work involving lead, cadmium and



chromium, and prepare in accordance with Section 02 83 00 LEAD REMEDIATION.

#### 1.7.3.11 Asbestos Hazard Abatement Plan

Identify the safety and health aspects of asbestos work, and prepare in accordance with Section 02 82 00 ASBESTOS REMEDIATION.

#### 1.7.3.12 Site Safety and Health Plan

Identify the safety and health aspects, and prepare in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

#### 1.7.3.13 Polychlorinated Biphenyls (PCB) Plan

Identify the safety and health aspects of Polychlorinated Biphenyls work, and prepare in accordance with Sections 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs) and 02 61 23 REMOVAL AND DISPOSAL OF PCB CONTAMINATED SOILS.

#### 1.7.3.14 Site Demolition Plan

Identify the safety and health aspects, and prepare in accordance with Section 02 41 00 DEMOLITION and referenced sources.

### 1.8 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1, Section 1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

#### 1.8.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

#### 1.8.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must review the AHA for that work and sign a signature log specifically

maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

## 1.9 DISPLAY OF SAFETY INFORMATION

### 1.9.1 Safety Bulletin Board

Prior to commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, may be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, Section 01.A.07. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

### 1.9.2 Safety and Occupational Health (SOH) Deficiency Tracking System

Establish a SOH deficiency tracking system that lists and monitors the status of SOH deficiencies in chronological order. Use the tracking system to evaluate the effectiveness of the APP. A monthly evaluation of the data must be discussed in the QC or SOH meeting with everyone on the project. The list must be posted on the project bulletin board and updated daily, and provide the following information:

- a. Date deficiency identified;
- b. Description of deficiency;
- c. Name of person responsible for correcting deficiency;
- d. Projected resolution date;
- e. Date actually resolved.

## 1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

## 1.11 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment in accordance with EM 385-1-1. Government has no responsibility to provide emergency medical treatment.

## 1.12 NOTIFICATIONS and REPORTS

### 1.12.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents,

incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, or any property damage. For LHE or rigging mishaps, notify the Contracting Officer as soon as practical but not more than four hours after mishap. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); load handling equipment or rigging; fall from height (any level other than same surface); and underwater diving. These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

Within notification include Contractor name; Contract title; type of Contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (for example, type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any mishap.

#### 1.12.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. The Contracting Officer will provide copies of any required or special forms.
- b. Near Misses: Near miss reports are considered positive and proactive Contractor safety management actions.

#### 1.12.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

#### 1.12.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Provide a FORM 16-1 Certificate of Compliance for LHE entering an activity under this Contract and in accordance with EM 385-1-1. Post certifications on the crane.

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section 16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

### 1.13 HOT WORK

#### 1.13.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e. welding or cutting) or operating other flame-producing/spark producing devices, from the Moody AFB Fire Department. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two 20 pound 4A:20 BC

rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch must be trained in accordance with [NFPA 51B](#) and remain on-site for a minimum of one hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire [Department](#) phone number. REPORT ANY FIRE, NO MATTER HOW SMALL, TO THE RESPONSIBLE FIRE [DEPARTMENT](#) IMMEDIATELY.

#### 1.13.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist, or Certified Industrial Hygienist for "HOT WORK" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in [EM 385-1-1](#), Section 06.H

#### 1.14 RADIATION SAFETY REQUIREMENTS

Submit [License Certificates](#), employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer and Radiation Safety Office (RSO) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records whenever licensed radiological materials or ionizing equipment are on Government property.

Protect workers from radiation exposure in accordance with [10 CFR 20](#), ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

##### 1.14.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray [Radiography Operation Planning Work Sheet](#) to Contracting Officer 14 days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the [Portable Gauge Operations Planning Worksheet](#) instead. The Contracting Officer will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

##### 1.14.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. For gamma

radiography materials and equipment, a Government escort is required for any travels on the Installation. The Government authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor for gamma sources onto the Installation, to the job site, and off the Installation. For portable machine sources of ionizing radiation, including moisture density and XRF, the Government authorized representative will meet the Contractor at the job site.

Provide a copy of all calibration records, and utilization records for radiological operations performed on the site.

#### 1.14.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

#### 1.14.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

#### 1.14.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

#### 1.14.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site Radiation Safety Officer (RSO) of any Radioactive Material use.

#### 1.14.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 p.m. on weekdays.

#### 1.14.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

#### 1.15 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with Section 34 of EM 385-1-1, OSHA 29 CFR 1926, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, and OSHA Directive CPL 2.100. Any potential for a hazard in the confined space requires a permit system to be used.

##### 1.15.1 Entry Procedures

Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

##### 1.15.2 Forced Air Ventilation

Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.

##### 1.15.3 Sewer Wet Wells

Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

##### 1.15.4 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

#### 1.16 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must comply with the applicable Storm Plan and:

- a. Secure outside equipment and materials and place materials that could be damaged in protected areas.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- c. Ensure that temporary erosion controls are adequate.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

##### 3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn or carried/available on each person. Mandatory PPE includes:

- a. Hard Hat
- b. Long Pants
- c. Appropriate Safety Shoes
- d. Appropriate Class Reflective Vests

#### 3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. Develop an employee check-in/check-out communication procedure to ensure employee safety.

#### 3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this Contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

#### 3.1.3 Unforeseen Hazardous Material

Contract documents identify materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If material(s) that may be hazardous to human health upon disturbance are encountered during construction operations, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to FAR 52.243-4 Changes and FAR 52.236-2 Differing Site Conditions.

### 3.2 UTILITY OUTAGE REQUIREMENTS

Apply for utility outages at least 10 working days in advance. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1, Section 11.A.02 (Isolation). Some examples of energy isolation devices and procedures are highlighted in EM 385-1-1, Section 12.D. In accordance with EM 385-1-1, Section 12.A.01, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of HECP and HEC procedures, as well as applicable Activity Hazard Analyses (AHAs). In accordance with EM 385-1-1, Section 11.A.02 and NFPA 70E, work on energized electrical circuits must not be performed without prior Government authorization. Government permission is considered through the permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

### 3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1, Section 12.A. This meeting must include the Prime Contractor, the Prime and subcontractors performing the work, the Contracting Officer, and the Installation representative, and Installation Utilities representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with HECP training in accordance with EM 385-1-1, Section 12.C. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

### 3.4 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, ASSP A10.44, NFPA 70E, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

#### 3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1, Section 12.A.02. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.



### 3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECF. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1, Sections 05.I and 11.B. Install personal protective grounds, with tags, to eliminate the potential for induced voltage in accordance with EM 385-1-1, Section 12.E.06.

### 3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECF. In accordance with EM 385-1-1, Section 12.E.08, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

## 3.5 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with ASSP Z359.2 and EM 385-1-1, Sections 21.A and 21.D.

### 3.5.1 Training

Institute a fall protection training program. As part of the Fall Protection Program, provide training for each employee who might be exposed to fall hazards and using personal fall protection equipment. Provide training by a competent person for fall protection in accordance with EM 385-1-1, Section 21.C. Document training and practical application of the competent person in accordance with EM 385-1-1, Section 21.C.04 and ASSP Z359.2 in the AHA.

### 3.5.2 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific Fall Protection and Prevention Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Section 21.I, 29 CFR 1926.500 Subpart M, ASSP Z359.0, ASSP Z359.1, ASSP Z359.2, ASSP Z359.3, ASSP Z359.4, ASSP Z359.6, ASSP Z359.7, ASSP Z359.11, ASSP Z359.12, ASSP Z359.13, ASSP Z359.14, ASSP Z359.15, ASSP Z359.16 and ASSP Z359.18.

### 3.5.2.1 Additional Personal Fall Protection Measures

In addition to the required fall protection systems, other protective measures such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with [EM 385-1-1](#), Sections 21.0 through 21.0.06. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

### 3.5.2.2 Personal Fall Protection Equipment

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. Equip all full body harnesses with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with [EM 385-1-1](#), Section 21.I.06.

### 3.5.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

#### a. Low Sloped Roofs:

- (1) For work within 6 feet from unprotected edge of a roof having a slope less than or equal to 4:12 (vertical to horizontal), protect personnel from falling by the use of conventional fall protection systems (personal fall arrest/restraint systems, guardrails, or safety nets) in accordance with [EM 385-1-1](#), Section 21 and [29 CFR 1926.500](#). A safety monitoring system is not adequate fall protection and is not authorized.
- (2) For work greater than 6 feet from the unprotected roof edge, addition to the use of conventional fall protection systems the use of a warning line system is also permitted, in accordance with [29 CFR 1926.500](#) and [EM 385-1-1](#), Section 21.L.

#### b. Steep-Sloped Roofs: Work on a roof having a slope greater than 4:12 (vertical to horizontal) requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also applies to residential or housing type construction.

### 3.5.4 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured horizontal lifelines (HLL) must be designed, installed, certified and used, under the supervision of a qualified person, for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500). The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

### 3.5.5 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01 and 29 CFR 1926 Subpart M.

### 3.5.6 Rescue and Evacuation Plan and Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP). The plan must be in accordance with the requirements of EM 385-1-1, ASSP Z359.2, and ASSP Z359.4.

## 3.6 WORK PLATFORMS

### 3.6.1 Scaffolding

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Comply with the following requirements:

- a. Scaffold platforms greater than 20 feet in height must be accessed by use of a scaffold stair system.
- b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 20 feet maximum in height.
- c. An adequate gate is required.
- d. Employees performing scaffold erection and dismantling must be qualified.
- e. Scaffold must be capable of supporting at least four times the maximum intended load, and provide appropriate fall protection as delineated in the accepted fall protection and prevention plan.
- f. Stationary scaffolds must be attached to structural building components

to safeguard against tipping forward or backward.

- g. Special care must be given to ensure scaffold systems are not overloaded.
- h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.
- i. Scaffolding other than suspended types must bear on base plates upon wood mudsills ( 2 in x 10 in x 8 in minimum) or other adequate firm foundation.
- j. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 6 feet.
- k. Delineate fall protection requirements when working above 6 feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

### 3.6.2 Elevated Aerial Work Platforms (AWPs)

Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP). Lanyards used must be sufficiently short to prohibit worker from climbing out of basket. The climbing of rails is prohibited. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100 percent tie-off is used for the transfer.

Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

## 3.7 EQUIPMENT

### 3.7.1 Material Handling Equipment (MHE)

- a. Material handling equipment such as forklifts must not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. Material handling equipment fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. Material Handling Equipment Operators must be trained in accordance with OSHA 29 CFR 1910, Subpart N.
- c. Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

### 3.7.2 Load Handling Equipment (LHE)

The following requirements apply. In exception, these requirements do not apply to commercial truck mounted and articulating boom cranes used solely to deliver material and supplies (not prefabricated components, structural steel, or components of a systems-engineered metal building) where the lift consists of moving materials and supplies from a truck or trailer to the ground; to cranes installed on mechanics trucks that are used solely in the repair of shore-based equipment; to crane that enter the activity but are not used for lifting; nor to other machines not used to lift loads suspended by rigging equipment. However, LHE accidents occurring during such operations must be reported.

- a. Equip cranes and derricks as specified in [EM 385-1-1](#), Section 16.
- b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with [EM 385-1-1](#), Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Contractor's operator must remain with the crane during the spot check. Rigging gear must be in accordance with OSHA, [ASME B30.9](#) Standards safety standards.
- c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in [ASME B30.5](#)). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with [ASME B30.5](#) for mobile and locomotive cranes, [ASME B30.22](#) for articulating boom cranes, [ASME B30.3](#) for construction tower cranes, [ASME B30.8](#) for floating cranes and floating derricks, [ASME B30.9](#) for slings, [ASME B30.20](#) for below the hook lifting devices and [ASME B30.26](#) for rigging hardware.
- e. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of [EM 385-1-1](#) Section 11, and [ASME B30.5](#) or [ASME B30.22](#) as applicable.
- f. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.
- g. Inspect, maintain, and recharge portable fire extinguishers as specified in [NFPA 10](#), Standard for Portable Fire Extinguishers.
- h. All employees must keep clear of loads about to be lifted and of suspended loads, except for employees required to handle the load.
- i. Use cribbing when performing lifts on outriggers.
- j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- k. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.

- l. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.
- m. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.
- n. Certify that all LHE operators have been trained in proper use of all safety devices (e.g. anti-two block devices).
- o. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.
- q. Follow FAA guidelines when required based on project location.

#### 3.7.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator must be kept on the project site for review.
- b. Manufacture specifications or owner's manual for the equipment must be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

#### 3.7.4 Base Mounted Drum Hoists

- a. Operation of base mounted drum hoists must be in accordance with EM 385-1-1 and ASSP A10.22.
- b. Rigging gear must be in accordance with applicable ASME/OSHA standards.
- c. When used on telecommunication towers, base mounted drum hoists must be in accordance with TIA-1019, TIA-222, ASME B30.7, 29 CFR 1926.552, and 29 CFR 1926.553.
- d. When used to hoist personnel, the AHA must include a written standard operating procedure. Operators must have a physical examination in accordance with EM 385-1-1 Section 16.B.05 and trained, at a minimum, in accordance with EM 385-1-1 Section 16.U and 16.T. The base mounted drum hoist must also comply with OSHA Instruction CPL 02-01-056 and ASME B30.23.
- e. Material and personnel must not be hoisted simultaneously.
- f. Personnel cage must be marked with the capacity (in number of persons) and load limit in pounds.

- g. Construction equipment must not be used for hoisting material or personnel or with trolley/tag lines. Construction equipment may be used for towing and assisting with anchoring guy lines.

#### 3.7.5 Use of Explosives

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, must be only where directed and in approved storage facilities. These facilities must be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

### 3.8 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

#### 3.8.1 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

#### 3.8.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within 3 feet of the underground system.

#### 3.8.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever Contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company must locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the Contractor from meeting this requirement.

### 3.9 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Sections 11 and 12.

#### 3.9.1 Conduct of Electrical Work

As delineated in [EM 385-1-1](#), electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with [ASTM F855](#) and [IEEE 1048](#). Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by [NFPA 70](#), high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by [NFPA 70E](#). Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and [29 CFR 1910.147](#).

### 3.9.2 Qualifications

Electrical work must be performed by QP with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State, Local requirements applicable to where work is being performed.

### 3.9.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with [NFPA 70E](#).

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in [NFPA 70E](#) requirements and procedures. Unless permitted by [NFPA 70E](#), no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

### 3.9.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with [NFPA 70](#) and [IEEE C2](#) to provide a permanent, continuous and effective path to ground unless otherwise noted by [EM 385-1-1](#).

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.



### 3.9.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

-- End of Section --

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## SECTION 01 42 00

## SOURCES FOR REFERENCE PUBLICATIONS

02/19

## PART 1 GENERAL

## 1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

## 1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AACE INTERNATIONAL (AACE)  
1265 Suncrest Towne Centre Drive  
Morgantown, WV 26505-1876 USA  
Ph: 304-296-8444  
Fax: 304-291-5728  
Internet: <https://web.aacei.org/>

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)  
30 West University Drive  
Arlington Heights, IL 60004-1893  
Ph: 847-394-0150  
Fax: 847-253-0088  
E-mail: [communications@amca.org](mailto:communications@amca.org)  
Internet: <http://www.amca.org>

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)  
2111 Wilson Blvd, Suite 400  
Arlington, VA 22201  
Ph: 703-524-8800  
Internet: <http://www.ahrinet.org>

ALUMINUM ASSOCIATION (AA)  
1400 Crystal Drive  
Suite 430  
Arlington, VA 22202  
Ph: 703-358-2960  
E-Mail: [info@aluminum.org](mailto:info@aluminum.org)  
Internet: <https://www.aluminum.org/>

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)  
1900 E Golf Rd, Suite 1250  
Schaumburg, IL 60173  
Ph: 847-303-5664

E-mail: [customerservice@aamanet.org](mailto:customerservice@aamanet.org)  
Internet: <https://aamanet.org/>

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)  
444 North Capital Street, NW, Suite 249  
Washington, DC 20001  
Ph: 202-624-5800  
Fax: 202-624-5806  
E-Mail: [info@ashto.org](mailto:info@ashto.org)  
Internet: <https://www.transportation.org/>

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)  
1 Davis Drive  
P.O. Box 12215  
Research Triangle Park, NC 27709-2215  
Ph: 919-549-8141  
Fax: 919-549-8933  
Internet: <https://www.aatcc.org/>

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)  
330 N. Wabash Ave., Suite 2000  
Chicago, IL 60611  
Ph: 202-367-1155  
E-mail: [info@americanbearings.org](mailto:info@americanbearings.org)  
Internet: <https://www.americanbearings.org/>

AMERICAN COLLEGE OF RADIOLOGY (ACR)  
1891 Preston White Dr.  
Reston, VA 20191  
Ph: 703-648-8900  
E-mail: [info@acr.org](mailto:info@acr.org)  
Internet: <https://www.acr.org/>

AMERICAN CONCRETE INSTITUTE (ACI)  
38800 Country Club Drive  
Farmington Hills, MI 48331-3439  
Ph: 248-848-3700  
Fax: 248-848-3701  
Internet: <https://www.concrete.org/>

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)  
8445 Freeport Parkway, Suite 350  
Irving, TX 75063-2595  
Ph: 972-506-7216  
Fax: 972-506-7682  
E-mail: [info@concrete-pipe.org](mailto:info@concrete-pipe.org)  
Internet: <https://www.concretepipe.org/>

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)  
1330 Kemper Meadow Drive  
Cincinnati, OH 45240  
Ph: 513-742-2020  
Fax: 513-742-3355  
Internet: <https://www.acgih.org/>

AMERICAN FOREST FOUNDATION (AFF)  
American Tree Farm System  
2000 M Street, NW, Suite 550

Washington, DC 20036  
Ph: 202-765-3660  
Fax: 202-827-7924  
Email: [info@forestfoundation.org](mailto:info@forestfoundation.org)  
Internet: <https://www.treefarmssystem.org>

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)  
1001 N. Fairfax Street, Suite 500  
Alexandria, VA 22314-1587  
Ph: 703-684-0211  
Fax: 703-684-0242  
E-mail: [tech@agma.org](mailto:tech@agma.org)  
Internet: <https://www.agma.org/>

AMERICAN HARDBOARD ASSOCIATION (AHA)  
1210 West Northwest Highway  
Palatine, IL 60067  
Ph: 847-934-8800  
Fax: 847-934-8803  
E-mail: [aha@hardboard.org](mailto:aha@hardboard.org)  
Internet: <http://domensino.com/AHA/>

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)  
3141 Fairview Park Dr, Suite 777  
Falls Church, VA 22042  
Tel: 703-849-8888  
Fax: 703-207-3561  
E-mail: [infonet@aiha.org](mailto:infonet@aiha.org)  
Internet: <https://www.aiha.org/>

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)  
130 East Randolph, Suite 2000  
Chicago, IL 60601  
Ph: 312-670-5444  
Fax: 312-670-5403  
Steel Solutions Center: 866-275-2472  
E-mail: [solutions@aisc.org](mailto:solutions@aisc.org)  
Internet: <https://www.aisc.org/>

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)  
7012 South Revere Parkway, Suite 140  
Centennial, CO 80112  
Ph: 503-639-0651  
Fax: 503-684-8928  
E-mail: [mschoen@wclib.org](mailto:mschoen@wclib.org)  
Internet: <http://www.aitc-glulam.org>

AMERICAN IRON AND STEEL INSTITUTE (AISI)  
25 Massachusetts Avenue, NW Suite 800  
Washington, DC 20001  
Ph: 202-452-7100  
Internet: <https://www.steel.org/>

AMERICAN LADDER INSTITUTE (ALI)  
330 N. Wabash, Suite 2000  
Chicago, IL 60611  
Ph: 312-321-6806  
Fax: 312-673-6929  
E-mail: [info@americanladderinstitute.org](mailto:info@americanladderinstitute.org)

Internet: <https://www.americanladderinstitute.org>

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)  
7470 New Technology Way, Suite F  
Frederick, MD 21703  
Ph: 301-972-1700  
Fax: 301-540-8004  
E-mail: [alsc@alsc.org](mailto:alsc@alsc.org)  
Internet: <http://www.alsc.org>

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
1899 L Street, NW, 11th Floor  
Washington, DC 20036  
Ph: 202-293-8020  
Fax: 202-293-9287  
E-mail: [storemanager@ansi.org](mailto:storemanager@ansi.org)  
Internet: <https://www.ansi.org/>

AMERICAN PETROLEUM INSTITUTE (API)  
1220 L Street, NW  
Washington, DC 20005-4070  
Ph: 202-682-8000  
Internet: <https://www.api.org/>

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION  
(AREMA)  
4501 Forbes Blvd., Suite 130  
Lanham, MD 20706  
Ph: 301-459-3200  
E-mail: [info@arema.org](mailto:info@arema.org)  
Internet: <https://www.arema.org>

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)  
P.O. Box 28518  
1711 Arlingate Lane  
Columbus, OH 43228-0518  
Ph: 800-222-2768 or 614-274-6003  
Fax: 614-274-6899  
E-mail: [tjones@asnt.org](mailto:tjones@asnt.org)  
Internet: <https://www.asnt.org/>

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)  
1801 Alexander Bell Drive  
Reston, VA 20191  
Ph: 800-548-2723; 703-295-6300  
Internet: <https://www.asce.org/>

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)  
1791 Tullie Circle, NE  
Atlanta, GA 30329  
Ph: 404-636-8400 or 800-527-4723  
Fax: 404-321-5478  
E-mail: [ashrae@ashrae.org](mailto:ashrae@ashrae.org)  
Internet: <https://www.ashrae.org/>

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)  
Two Park Avenue  
New York, NY 10016-5990

Ph: 800-843-2763  
Fax: 973-882-1717  
E-mail: [customercare@asme.org](mailto:customercare@asme.org)  
Internet: <https://www.asme.org/>

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)  
520 N. Northwest Highway  
Park Ridge, IL 60068  
Ph: 847-699-2929  
E-mail: [customerservice@assp.org](mailto:customerservice@assp.org)  
Internet: <https://www.assp.org/>

AMERICAN WATER WORKS ASSOCIATION (AWWA)  
6666 W. Quincy Avenue  
Denver, CO 80235 USA  
Ph: 303-794-7711 or 800-926-7337  
Fax: 303-347-0804  
Internet: <https://www.awwa.org/>

AMERICAN WELDING SOCIETY (AWS)  
8669 NW 36 Street, #130  
Miami, FL 33166-6672  
Ph: 800-443-9353  
Internet: <https://www.aws.org/>

AMERICAN WOOD COUNCIL (AWC)  
222 Catoctin Circle SE, Suite 201  
Leesburg, VA 20175  
Ph: 800-890-7732  
Fax: 412-741-0609  
E-mail: [publications@awc.org](mailto:publications@awc.org)  
Internet: <https://www.awc.org/>

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)  
P.O. Box 361784  
Birmingham, AL 35236-1784  
Ph: 205-733-4077  
Fax: 205-733-4075  
Internet: <http://www.awpa.com>

APA - THE ENGINEERED WOOD ASSOCIATION (APA)  
7011 South 19th St.  
Tacoma, WA 98466-5333  
Ph: 253-565-6600  
Fax: 253-565-7265  
Internet: <https://www.apawood.org/>

ASM INTERNATIONAL (ASM)  
9639 Kinsman Road  
Materials Park, OH 44073-0002  
Ph: 440-338-5151 (US), 440-462-0292 (International)  
E-mail: [memberservicecenter@asminternational.org](mailto:memberservicecenter@asminternational.org)  
Internet: <https://www.asminternational.org/>

ASPHALT ROOFING MANUFACTURER'S ASSOCIATION (ARMA)  
750 National Press Building  
529 14th Street, NW  
Washington, DC 20045  
Ph: 202-591-2450

Fax: 202-591-2445  
Internet: <https://asphaltroofing.org/>

ASSOCIATION OF THE WALL AND CEILING INDUSTRY (AWCI)  
513 West Broad Street, Suite 210  
Falls Church, VA 22046  
Ph: 703-538-1600  
Fax: 703-534-8307  
Internet: <https://www.awci.org/>

ASTM INTERNATIONAL (ASTM)  
100 Barr Harbor Drive, P.O. Box C700  
West Conshohocken, PA 19428-2959  
Ph: 610-832-9500  
Fax: 610-832-9555  
E-mail: [service@astm.org](mailto:service@astm.org)  
Internet: <https://www.astm.org/>

BIFMA INTERNATIONAL (BIFMA)  
678 Front Ave. NW, Suite 150  
Grand Rapids, MI 49504-5368  
Ph: 616-285-3963  
E-mail: [email@bifma.org](mailto:email@bifma.org)  
Internet: <https://www.bifma.org/>

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)  
355 Lexington Avenue, 15th Floor  
New York, NY 10017  
Ph: 212-297-2122  
Fax: 212-370-9047  
Internet: <https://www.buildershardware.com/>

CALIFORNIA AIR RESOURCES BOARD (CARB)  
1001 I Street  
Sacramento, CA 95814  
Ph: 800-242-4450  
Email: [helpline@arb.ca.gov](mailto:helpline@arb.ca.gov)  
Internet: <https://ww2.arb.ca.gov/>

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)  
PO Box 997377, MS 0500  
Sacramento, CA 95899-7377  
Ph: 916-558-1784  
Internet: <https://www.cdph.ca.gov/>

CARPET AND RUG INSTITUTE (CRI)  
P.O. Box 2048  
Dalton, GA 30722-2048  
Ph: 706-278-3176  
Fax: 706-278-8835  
Internet: <https://carpet-rug.org/>

CEILINGS AND INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)  
1010 Jorie Blvd, Suite 30  
Oak Brook, IL 60523  
Ph: 630-584-1919  
Fax: 866-560-8537  
E-mail: [cisca@cisca.org](mailto:cisca@cisca.org)



Internet: <https://www.cisca.org>

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)  
1600 Clifton Road  
Atlanta, GA 30329-4027  
Ph: 800-232-4636  
TTY: 888-232-6348  
Internet: <https://www.cdc.gov>

COMPOSITE PANEL ASSOCIATION (CPA)  
19465 Deerfield Avenue, Suite 306  
Leesburg, VA 20176  
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Fax: 703-724-1588  
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Obtain Unified Facilities Criteria (UFC) from:  
Whole Building Design Guide (WBDG)  
National Institute of Building Sciences (NIBS)  
1090 Vermont Avenue NW, Suite 700  
Washington, DC 20005  
Ph: 202-289-7800  
Fax: 202-289-1092  
Internet:  
<https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc>

U.S. DEPARTMENT OF ENERGY (DOE)  
1000 Independence Avenue Southwest  
Washington, D.C. 20585  
Ph: 202-586-5000  
Fax: 202-586-4403  
E-mail: [The.Secretary@hq.doe.gov](mailto:The.Secretary@hq.doe.gov)  
Internet: <https://www.energy.gov/>

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)  
HUD User  
P.O. Box 23268  
Washington, DC 20026-3268  
Ph: 800-245-2691 or 202-708-3178  
TDD: 800-927-7589  
Fax: 202-708-9981  
E-mail: [helpdesk@huduser.gov](mailto:helpdesk@huduser.gov)  
Internet: <https://www.huduser.gov>

U.S. DEPARTMENT OF STATE (SD)  
2201 C Street, NW  
Washington, DC 20520  
Ph: 202-647-4000  
Internet: <https://www.state.gov/>

U.S. DEPARTMENT OF TRANSPORTATION (DOT)  
1200 New Jersey Ave., SE  
Washington, DC 20590  
Ph: 202-366-4000  
Internet: <https://www.transportation.gov/>

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)  
1200 Pennsylvania Avenue, N.W.  
Washington, DC 20004  
Ph: 202-564-4700  
Internet: <https://www.epa.gov>  
--- Some EPA documents are available only from:  
National Technical Information Service (NTIS)  
5301 Shawnee Road  
Alexandria, VA 22312  
Ph: 703-605-6060 or 1-800-363-2068  
Fax: 703-605-6880  
TDD: 703-487-4639  
E-mail: info@ntis.gov  
Internet: <https://www.ntis.gov/>

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)  
Order for sale documents from:  
Superintendent of Documents  
U.S. Government Publishing Office (GPO)  
732 N. Capitol Street, NW  
Washington, DC 20401  
Ph: 202-512-1800 or 866-512-1800  
Bookstore: 202-512-0132  
Internet: <https://www.gpo.gov/>  
Order free documents from:  
U.S. Department of Transportation  
Federal Aviation Administration  
800 Independence Avenue, SW  
Washington, DC 20591  
Ph: 866-835-5322  
Internet: <https://www.faa.gov/>

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)  
1200 New Jersey Ave., SE  
Washington, DC 20590  
Ph: 202-366-4000  
E-mail: ExecSecretariat.FHWA@dot.gov  
Internet: <https://www.fhwa.dot.gov/>  
Order from:  
Superintendent of Documents  
U.S. Government Publishing Office (GPO)  
732 N. Capitol Street, NW  
Washington, DC 20401  
Ph: 202-512-1800 or 866-512-1800  
Bookstore: 202-512-0132  
Internet: <https://www.gpo.gov/>

U.S. GENERAL SERVICES ADMINISTRATION (GSA)  
General Services Administration  
1800 F Street, NW  
Washington, DC 20405  
Ph: 1-844-472-4111  
Internet: <https://www.gsaelibrary.gsa.gov/ElibMain/home.do>

Obtain documents from:  
Acquisition Streamlining and Standardization Information System  
(ASSIST)  
Internet: <https://assist.dla.mil/online/start/>; account  
registration required

U. S. GREEN BUILDING COUNCIL (USGBC)  
2101 L St NW, Suite 500  
Washington, DC 20037  
Ph: 202-828-7422  
Internet: <https://new.usgbc.org/>

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)  
8601 Adelphi Road  
College Park, MD 20740-6001  
Ph: 866-272-6272  
Internet: <https://www.archives.gov/>  
Order documents from:  
Superintendent of Documents  
U.S. Government Publishing Office (GPO)  
732 N. Capitol Street, NW  
Washington, DC 20401  
Ph: 202-512-1800 or 866-512-1800  
Bookstore: 202-512-0132  
Internet: <https://www.gpo.gov/>

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)  
1322 Patterson Ave. SE, Suite 1000  
Washington Navy Yard, DC 20374-5065  
Ph: 202-685-9387  
Internet: <http://www.navfac.navy.mil>

U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)  
Commander Naval Sea Systems Command  
1333 Isaac Hull Ave., SE  
Washington Navy Yard, DC 20376  
Ph: 202-781-0000  
Internet: <https://www.navsea.navy.mil/>

UL ENVIRONMENT (ULE)  
2211 Newmarket Parkway, Suite 106  
Marietta, GA 30067  
Ph: 888-485-4733  
E-mail: [environment@ul.com](mailto:environment@ul.com)  
Intertet: <https://industries.ul.com/environment/>

UNDERWRITERS LABORATORIES (UL)  
2600 N.W. Lake Road  
Camas, WA 98607-8542  
Ph: 877-854-3577 or 360-817-5500  
E-mail: [CustomerExperienceCenter@ul.com](mailto:CustomerExperienceCenter@ul.com)  
Internet: <https://www.ul.com/>  
UL Directories available through IHS at <https://ihsmarkit.com/>

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)  
6980 S.W. Varns  
Tigard, OR 97223  
Ph: 503-639-0651  
Fax: 503-684-8928

E-mail: [info@wclib.org](mailto:info@wclib.org)  
Internet: <http://www.wclib.org>

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)  
1500 SW First Ave., Suite 870  
Portland, OR 97201  
Ph: 503-224-3930  
E-mail: [info@wwpa.org](mailto:info@wwpa.org)  
Internet: <http://www.wwpa.org>

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)  
2025 M Street, NW, Suite 800  
Washington, DC 20036-3309  
Ph: 202-367-1157  
or  
330 N Wabash Avenue, Suite 2000  
Chicago, IL 60611  
Ph: 312-321-6802  
E-mail: [membersupport@wdma.com](mailto:membersupport@wdma.com)  
Internet: <https://www.wdma.com/>

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)  
507 First Street  
Woodland, CA 95695  
Ph: 530-661-9591  
Fax: 530-661-9586  
E-mail: [info@wmma.com](mailto:info@wmma.com)  
Internet: <https://www.wmma.com/>

WOODWORK INSTITUTE (WI)  
3188 Industrial Blvd.  
West Sacramento, CA 95691  
Ph: 916-372-9943  
Fax: 916-372-9950  
E-mail: [info@woodinst.com](mailto:info@woodinst.com)  
Internet: <https://woodworkinstitute.com>

WOOLMARK COMPANY (WBI)  
NeueHouse  
110 East 25th Street, 3rd Floor  
New York, NY 10010  
or  
WeWork One Culver  
10000 Washington Blvd  
Culver City, CA 90232  
Ph: 347-767-3160  
E-mail: [woolmark.americas@wool.com](mailto:woolmark.americas@wool.com)  
internet: <https://www.woolmark.com/>

## PART 2 PRODUCTS

Not used

## PART 3 EXECUTION

Not used

-- End of Section --

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## SECTION 01 45 00.00 10

QUALITY CONTROL  
11/16, CHG 2: 11/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

**ASTM D3740** (2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

**ASTM E329** (2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

## 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the applicable **proposal per Task Order**.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section **01 33 00 SUBMITTAL PROCEDURES**:

**SD-01 Preconstruction Submittals****Contractor Quality Control (CQC) Plan; G****SD-06 Test Reports****Verification Statement**

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that complies with FAR 52.246-12 Inspection of Construction. QC consist of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all construction operations, both onsite and offsite, and be keyed to the

proposed construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

### 3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Submit no later than 5 calendar days prior to Preconstruction Conference, the Contractor Quality Control (CQC) Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

#### 3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all construction-operations, both onsite and offsite, including work by subcontractors fabricators, suppliers and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to an individual other than the project superintendent. The individual should be outside of the project superintendent's chain of command and must be shown as at least one level above the project superintendent in the chain of command.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer are required to be used.)

- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.
- j. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections. Where the applicable code issued by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the QC Plan.

### 3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in the Contractor Quality Control (CQC) Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.3 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

### 3.3 COORDINATION MEETING

Before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 5 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual

understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

### 3.4 QUALITY CONTROL ORGANIZATION

#### 3.4.1 Personnel Requirements

The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible for maintaining these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

#### 3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC System Manager is required to be a construction person with a minimum of 10 years in related work. This CQC System Manager is employed by the prime Contractor. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

#### 3.4.3 Additional Requirement

In addition to the above experience, the Contractor Quality Control (CQC) System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Contractors course. If the CQC System Manager does not have a current certification, obtain the CQM for Contractors course certification within 45 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

The Construction Quality Management Training certificate expires after 5 years. If the CQC System Manager's certificate has expired, retake the course to remain current.

#### 3.4.4 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

### 3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING are included in the contract, the submittals required by those sections have to be coordinated with Section 01 33 00 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

### 3.6 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

#### 3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
- b. Review of the Contract drawings.
- c. Check to assure that all materials and equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Review Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.
- f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
- g. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.

- k. The Government needs to be notified at least 24 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### 3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

- a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government needs to be notified at least 24 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.
- g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
- h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

### 3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

### 3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## 3.7 TESTS

### 3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

### 3.7.2 Testing Laboratories

All testing laboratories must be validated by the USACE Material Testing Center (MTC) for the tests to be performed. Information on the USACE MTC with web-links to both a list of validated testing laboratories and for the laboratory inspection request for can be found at:

<https://mtc.erdcdren.mil/>.

#### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel is required to meet criteria detailed in

ASTM D3740 and ASTM E329.

### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

## 3.8 COMPLETION INSPECTION

### 3.8.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC System Manager near the end of the work, or any increment of the work established by a time stated in FAR 52.211-10 Commencement, Prosecution, and Completion of Work, or by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

### 3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

### 3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative is required to be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands can also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance FAR 52.246-12 Inspection of Construction.

## 3.9 DOCUMENTATION



### 3.9.1 Quality Control Activities

Maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

- a. The name and area of responsibility of the Contractor/Subcontractor.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and specifications.

### 3.9.2 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government **weekly, by 1000 hours the following Monday, to include** days on which no work is performed. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the Contractor Quality Control (CQC) System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

### 3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

### 3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective

action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

## SECTION 01 45 35

## SPECIAL INSPECTIONS

11/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC

(2018) International Building Code

## 1.2 GENERAL REQUIREMENTS

Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections and Chapter 17 of ICC IBC. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the Prime Contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

## 1.3 DEFINITIONS

## 1.3.1 Continuous Special Inspections

Continuous Special Inspections is the constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

## 1.3.2 Perform

Perform these Special Inspections tasks for each welded joint or member.

## 1.3.3 Observe

Observe these Special Inspections items on a periodic daily basis. Operations need not be delayed pending these inspections.

## 1.3.4 Special Inspector (SI)

A qualified person retained by the Contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

## 1.3.5 Associate Special Inspector (ASI)

A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot

perform inspections without the SI on site.

#### 1.3.6 Third Party

A Special inspector must not be an employee of the Contractor or of any Sub-Contractor performing the work to be inspected.

#### 1.3.7 Contracting Officer

The Government official having overall authority for administrative contracting actions.

#### 1.3.8 Contractor's Quality Control (QC) Manager

An individual retained by the Prime Contractor and qualified in accordance with the Section 01 45 00.00 10 [QUALITY CONTROL](#) having the overall responsibility for the Contractor's QC organization.

#### 1.3.9 Structural Engineer of Record (SER)

A registered design professional responsible for the overall design and review of submittal documents prepared by others. The SER is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in the state in which the design professional works. The SER is also referred to as the Engineer of Record (EOR) in design code documents.

#### 1.3.10 Statement of Special Inspections (SSI)

A document developed by the SER identifying the material, systems, components and work required to have Special Inspections. This statement is included at the end of this specification.

#### 1.3.11 Schedule of Special Inspections (SSI)

A schedule which lists each of the required Special Inspections, the extent to which each Special Inspection is to be performed, and the required frequency for each in accordance with [ICC IBC](#) Chapter 17. This schedule is included at the end of this specification.

#### 1.3.12 Definable Feature of Work (DFOW)

An inspection group that is separate and distinct from other inspection groups, having inspection requirements or inspectors that are unique.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 [SUBMITTAL PROCEDURES](#):

#### [SD-01 Preconstruction Submittals](#)

[SIOR Letter of Acceptance](#); G

Special Inspections [Project Manual](#); G

Special Inspections Agency's [Written NDT Practices](#) with method and

evidence of regular equipment calibration where applicable

#### SD-06 Test Reports

Special Inspections [Daily Reports](#)

Special Inspections [Biweekly Reports](#)

#### SD-07 Certificates

[AISC Certified Steel Fabricator](#)

[Steel Truss Plant Quality Assurance Program](#)

[Wood Truss Plant Quality Assurance Program](#)

[AC472 Accreditation](#)

[Steel Joist Institute Membership](#)

[Precast Concrete Institute \(PCI\) Certified Plant](#)

[Certificate of Compliance](#)

[Special Inspector of Record Qualifications; G](#)

[Special Inspector Qualifications; G](#)

[Qualification Records](#) for NDT technicians

#### SD-11 Closeout Submittals

[Interim Report](#) of Special Inspections for Each DFO; G

[Comprehensive Final Report](#) of Special Inspections; G

### 1.5 SPECIAL INSPECTOR QUALIFICATIONS

Submit qualifications for each [special inspector](#).

#### 1.5.1 Steel Construction and High Strength Bolting

##### 1.5.1.1 Special Inspector

- a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or
- b. Registered Professional Engineer with three years of related experience

##### 1.5.1.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.2 Welding Structural Steel

##### 1.5.2.1 Special Inspector

- a. ICC Structural Welding Special Inspector certificate with one year of related experience, or

- b. AWS Certified Welding Inspector
- 1.5.2.2 Associate Special Inspector
  - AWS Certified Associate Welding Inspector
- 1.5.3 Nondestructive Testing of Welds
  - 1.5.3.1 Special Inspector
    - NDT Level III Certificate
  - 1.5.3.2 Associate Special Inspector
    - NDT Level II Certificate plus one year of related experience
- 1.5.4 Cold Formed Steel Framing
  - 1.5.4.1 Special Inspector
    - a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or
    - b. ICC Commercial Building Inspector with one year of experience, or
    - c. ICC Residential Building Inspector with one year of experience, or
    - d. Registered Professional Engineer with three years related experience
  - 1.5.4.2 Associate Special Inspector
    - Engineer-In-Training with one year of related experience.
- 1.5.5 Concrete Construction
  - 1.5.5.1 Special Inspector
    - a. ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or
    - b. ACI Concrete Construction Special Inspector, or
    - c. Registered Professional Engineer with three years of related experience
  - 1.5.5.2 Associate Special Inspector
    - a. ACI Concrete Construction Special Inspector in Training, or
    - b. Engineer-In-Training with one year of related experience
- 1.5.6 Prestressed Concrete Construction
  - 1.5.6.1 Special Inspector
    - a. ICC Pre-stressed Special Inspector Certificate with one year of related experience, or
    - b. PCI Quality Control Technician/ Inspector Level II Certificate with one

year of related experience, or

- c. Registered Professional Engineer with three years of related experience

#### 1.5.6.2 Associate Special Inspector

- a. PCI Quality Control Technician/ Inspector Level I Certificate with one year of related experience, or
- b. Engineer-In-Training with one year of related experience

#### 1.5.7 Post-tensioned Concrete Construction

##### 1.5.7.1 Special Inspector

- a. PTI Level 2 Unbonded PT Inspector Certificate, or
- b. Registered Professional Engineer with three years of related experience

##### 1.5.7.2 Associate Special Inspector

- a. PTI Level 1 Unbonded PT Inspector Certificate with one year of related experience, or
- b. Engineer-In-Training with one year of related experience

#### 1.5.8 Masonry Construction

##### 1.5.8.1 Special Inspector

- a. ICC Structural Masonry Special Inspector Certificate with one year of related experience, or
- b. Registered Professional Engineer with three years of related experience

##### 1.5.8.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.9 Wood

##### 1.5.9.1 Special Inspector

- a. ICC Commercial Building Inspector Certificate with one year of related experience, or
- b. ICC Residential Building Inspector with one year of experience, or
- c. Registered Professional Engineer with three years of related experience

##### 1.5.9.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.10 Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements

##### 1.5.10.1 Special Inspector

- a. ICC Soils Special Inspector Certificate with one year of related experience, or
- b. NICET Soils Technician Level II Certificate in Construction Material Testing, or
- c. Geologist-In-Training with three years of related experience, or
- d. Registered Professional Engineer with three years of related experience

#### 1.5.10.2 Associate Special Inspector

- a. NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or
- b. Engineer-In-Training with one year of related experience

#### 1.5.11 Deep Foundations

##### 1.5.11.1 Special Inspector

- a. NICET Soils Technician Level II Certificate in Construction Material Testing, or
- b. Geologist-In-Training with three years of related experience, or
- c. Registered Professional Engineer with three years of related experience

##### 1.5.11.2 Associate Special Inspector

- a. NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or
- b. NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or
- c. Engineer-In-Training with one year of related experience

#### 1.5.12 Sprayed Fire Resistant Material

##### 1.5.12.1 Special Inspector

- a. ICC Spray-applied Fireproofing Special Inspector Certificate, or
- b. ICC Fire Inspector I Certificate with one year of related experience, or
- c. Registered Professional Engineer or Architect with related experience

##### 1.5.12.2 Associate Special Inspector

Engineer-In-Training with one year of related experience

#### 1.5.13 Mastic and Intumescent Fire Resistant Coatings

##### 1.5.13.1 Special Inspector

- a. ICC Spray-applied Fireproofing Special Inspector Certificate, or
- b. ICC Fire Inspector I Certificate with one year of related experience, or



- c. Registered Professional Engineer or Architect with related experience

#### 1.5.13.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.14 Exterior Insulation and Finish System (EIFS)

##### 1.5.14.1 Special Inspector

- a. AWCI EIFS Inspector Certificate, or
- b. Exterior Design Institute Certificate, or
- c. Registered Professional Engineer or Architect with related experience

##### 1.5.14.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.15 Fire-Resistant Penetrations and Joints

##### 1.5.15.1 Special Inspector

- a. Passed the UL Firestop Exam with one year of related experience, or
- b. Passed the FM Firestop Exam with one year of related experience, or
- c. Registered Professional Engineer with related experience

##### 1.5.15.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.16 Smoke Control

##### 1.5.16.1 Special Inspector

- a. AABC Technician Certification with one year of related experience, or
- b. Registered Professional Engineer with related experience

##### 1.5.16.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

#### 1.5.17 [Special Inspector of Record](#) (SIOR)

Registered Professional Engineer with five years of related experience.

## PART 2 PRODUCTS

### 2.1 FABRICATOR SPECIAL INSPECTIONS

Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special

Inspections. Submit the following certification certifications to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

[AISC Certified Steel Fabricator.](#)

Truss Plate Institute (TPI) [steel truss plant quality assurance program certification.](#)

Truss Plate Institute (TPI) [wood truss plant quality assurance program certification.](#)

International Accreditation Service, [AC472 Accreditation](#)

[Steel Joist Institute Membership](#)

Precast Concrete Institute (PCI) [Certified Plant](#), Group C

At the completion of fabrication, submit a [certificate of compliance](#), to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance with the construction documents.

## PART 3 EXECUTION

### 3.1 RESPONSIBILITIES

#### 3.1.1 Quality Control Manager

- a. Supervise all Special Inspectors required by the Contract Documents and the IBC.
- b. Verify the qualifications of all of the Special Inspectors.
- c. Verify the qualifications of fabricators.
- d. Maintain a 3-ring binder for the Special Inspector's daily and [biweekly reports](#). This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the SER.
- e. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.

#### 3.1.2 Special Inspectors

- a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections.
- b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.
- c. Submit a copy of the [daily reports](#) to the QC Manager.
- d. Report discrepancies that are observed during Special Inspections to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.

- e. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:
  - (1) A brief summary of the work performed during the reporting time frame.
  - (2) Changes and discrepancies with the drawings, specifications, and mechanical or electrical component certification, that were observed during the reporting period.
  - (3) Discrepancies which were resolved or corrected.
  - (4) A list of nonconforming items requiring resolution.
  - (5) All applicable test result including nondestructive testing reports.
- f. At the completion of the project submit a [comprehensive final report](#) of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.

### 3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Contracting Officer to accept such work.

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## SECTION 01 50 00

## TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

11/20, CHG 1: 08/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

**AWWA C511** (2017) Reduced-Pressure Principle Backflow Prevention Assembly

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 70** (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

**NFPA 241** (2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

## U.S. ARMY CORPS OF ENGINEERS (USACE)

**EM 385-1-1** (2014) Safety -- Safety and Health Requirements Manual

## U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

**MUTCD** (2009; Rev 2012) Manual on Uniform Traffic Control Devices

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-01 Preconstruction Submittals**

Construction Site Plan; G

Traffic Control Plan; G

Haul Road Plan; G

Contractor Computer Cybersecurity Compliance Statements; G

Contractor Temporary Network Cybersecurity Compliance Statements; G

### SD-06 Test Reports

#### Backflow Preventer Tests

### SD-07 Certificates

#### Backflow Tester Certification

#### Backflow Preventers Certificate of Full Approval

## 1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit for Government approval a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

## 1.4 BACKFLOW PREVENTERS CERTIFICATE

### 1.4.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the **backflow tester** has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with a company participating in other phases of this Contract.

### 1.4.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

## 1.5 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (58 mph) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, **EM 385-1-1** Section 01 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

- a. **HURCON FOUR** (Sustained winds of 58 mph or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 3.3

feet high. Remove all debris, trash, or objects that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

- b. **HURCON THREE** (Sustained winds of 58 mph or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.
- c. **HURCON TWO** (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.
- d. **HURCON ONE**. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

## 1.6 CYBERSECURITY DURING CONSTRUCTION

Meet the following requirements throughout the construction process.

### 1.6.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

#### 1.6.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

#### 1.6.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

#### 1.6.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

#### 1.6.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>. Each Statement must be signed by a cybersecurity representative for the relevant company.

#### 1.6.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

##### 1.6.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

#### 1.6.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification.

#### 1.6.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

#### 1.6.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

#### 1.6.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

## PART 2 PRODUCTS

### 2.1 TEMPORARY SIGNAGE

#### 2.1.1 Bulletin Board

Prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying



the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 Section 01 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, and in location as approved by the Contracting Officer.

### 2.1.2 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1 Section 04. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily. Post signs at all points of entry designating the construction site as a hard hat area.

## 2.2 TEMPORARY TRAFFIC CONTROL

### 2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this Contract in accordance with EM 385-1-1 Section 04. Construct with suitable grades and widths; avoid sharp curves, blind corners, and dangerous cross traffic. Submit [haul road plan](#) for approval. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and haul roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

### 2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

## 2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

### 2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid

and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

### 2.3.2 Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels 8 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

### 2.3.3 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing 8 feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various surfaces such as sand, soil, asphalt or concrete as necessary. Chain link fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection. Completely remove fencing and posts at the completion of construction and restore surfaces disturbed or damaged to its original condition. Locate and identify underground utilities prior to setting fence posts. Equip fence with a lockable gate. Gate must remain locked when construction personnel are not present.

## 2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1 Section 11, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

## 2.5 BACKFLOW PREVENTERS

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval is not acceptable.

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with [150 pound] [\_\_\_\_\_] flanged [cast iron],[ ductile iron,] [bronze,] [brass] mounted gate valve [and strainer], [304] [\_\_\_\_\_] stainless steel or bronze, internal parts.

## PART 3 EXECUTION

### 3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not interfere with existing and established parking requirements of the Government installation.

### 3.2 AVAILABILITY AND USE OF UTILITY SERVICES

#### 3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Payment for Utility Services

- a. The Government will make all reasonably required utilities available from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed will be charged to or paid at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve utilities furnished without charge.
- b. Reasonable amounts of the following utilities will be made available [without charge.] [at the prevailing rates.] [at the following rates:]

Utility Services		
	Cost (\$) per	Unit
Electricity		
Potable Water		
Salt Water		
Compressed Air		
Steam		
Natural Gas		
Sanitary Sewer		

- c. The point at which the Government will deliver such utilities or services and the quantity available is . Pay all costs incurred in connecting, converting, and transferring the utilities to the work. Make connections, including [providing backflow-preventing devices on connections to domestic water lines;] [providing meters;] and providing transformers; and make disconnections.
- d. The Contractor must provide their own utilities.

3.2.3 Meters and Temporary Connections

Provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. Do not make the final electrical connection.

3.2.4 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of \$50.00 will be required. The last monthly bills for the

fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed prior to the end of the current fiscal year.

### 3.2.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated appurtenances. Pay all outstanding utility bills before final acceptance of the work by the Government.

### 3.2.6 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1 Section 02. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into a municipal, district, or commercial sanitary sewer system. Penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

### 3.2.7 Telephone

Make arrangements and pay all costs for telephone facilities desired.

### 3.2.8 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

## 3.3 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

### 3.3.1 Restricted Access Areas

The Government will monitor work in areas that are indicated as Secure or Restricted. Notify Contracting Officer at least 14 calendar days prior to starting work in these areas.

## 3.4 TRAFFIC PROVISIONS

### 3.4.1 Maintenance of Traffic

- a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan for Government approval detailing the proposed controls to traffic

movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain all permits required for modification to traffic movements outside Station's jurisdiction. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

- b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.
- c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.
- d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

#### 3.4.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Provide self-illuminated (lighted) barricades during hours of darkness. Brightly-colored (orange) vests are required for all personnel working in roadways. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

#### 3.4.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations for any installation activity without notification to and approval by the Contracting Officer.

#### 3.4.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

#### 3.5 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and

certification forms conforming to those outlined in the latest edition of the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and monthly thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

### 3.6 CONTRACTOR'S TEMPORARY FACILITIES

Contractor-owned or -leased trailers must be identified by Government assigned numbers. Size and location of the number will comply with the [Moody Installation Design Guide](#). Apply the number to the trailer within 14 calendar days of notification, or sooner, if directed by the Government. Temporary facilities must meet requirements as identified in [EM 385-1-1](#) Section 04.

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with [EM 385-1-1](#) Section 04. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

#### 3.6.1 Administrative Field Offices

Provide and maintain , [as required](#), administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel [unless previously arranged through the Contracting Officer](#).

In the event a new building is constructed for the temporary project field office, it must be a minimum [12 feet](#) in width, [16 feet](#) in length and have a minimum of [7 feet](#) headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery-operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Provide approved sanitary facilities. Screen the windows and doors and provide the doors with deadbolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins must be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, provide air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature [20 degrees F](#) below the outside temperature when the outside temperature is [95 degrees F](#). Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

#### 3.6.2 Storage Area

Construct a temporary [6 foot](#) high chain link fence around trailers and materials. Include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in

lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, and will be traversed with construction equipment or other vehicles, must be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

### 3.6.3 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

### 3.6.4 Appearance of Trailers

- a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.
- b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

### 3.6.5 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish Contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

### 3.6.6 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are

completely sealed off to protect materials and equipment in the building from damage.

#### 3.6.6.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

#### 3.7 PLANT COMMUNICATIONS

Whenever the individual elements of the plant are located so that operation by normal voice between these elements is not satisfactory, install a satisfactory means of communication, such as telephone or other suitable devices and make available for use by Government personnel.

#### 3.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the Contract and, upon completion and acceptance of the work, remove from the work site.

#### 3.9 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

#### 3.10 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --



## SECTION 01 57 19

## TEMPORARY ENVIRONMENTAL CONTROLS

11/15, CHG 5: 08/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1910.1053	Respirable Crystalline Silica
29 CFR 1926.1153	Respirable Crystalline Silica
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 64	Compliance Assurance Monitoring
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 261.7	Residues of Hazardous Waste in Empty Containers
40 CFR 262	Standards Applicable to Generators of

	Hazardous Waste
40 CFR 262.31	Standards Applicable to Generators of Hazardous Waste-Labeling
40 CFR 262.34	Standards Applicable to Generators of Hazardous Waste-Accumulation Time
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 171	General Information, Regulations, and Definitions

49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

## 1.2 DEFINITIONS

### 1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink.  
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink.  
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

### 1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

### 1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

### 1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

### 1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

### 1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

#### 1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that: Is regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.120; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

#### 1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibit a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D.

#### 1.2.9 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

#### 1.2.10 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by installations to obtain NPDES permit coverage for their stormwater discharges.

#### 1.2.11 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

#### 1.2.12 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in

compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

#### 1.2.13 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

#### 1.2.14 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

#### 1.2.15 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

##### 1.2.15.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

##### 1.2.15.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

##### 1.2.15.3 Material Not Regulated As Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air

emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

#### 1.2.15.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 263.

#### 1.2.15.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

#### 1.2.15.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

#### 1.2.15.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

#### 1.2.15.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

#### 1.2.16 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, creeks or "waters of the United States". Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

#### 1.2.17 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

#### 1.2.17.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

#### 1.2.18 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

#### 1.2.19 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

#### 1.2.20 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at [40 CFR 273](#).

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

#### [SD-01 Preconstruction Submittals](#)

[Preconstruction Survey](#)

[Solid Waste Management Permit; G](#)

[Regulatory Notifications; G](#)

[Environmental Protection Plan; G](#)

[Dirt and Dust Control Plan; G](#)

[Employee Training Records;](#)

[Environmental Manager Qualifications;](#)

#### [SD-06 Test Reports](#)

[Monthly Solid Waste Disposal Report; G](#)

## SD-07 Certificates

Employee Training Records;

Certificate of Competency

Erosion and Sediment Control Inspector Qualifications

## SD-11 Closeout Submittals

Waste Determination Documentation; G

Disposal Documentation for Hazardous and Regulated Waste; G

Assembled Employee Training Records;

Solid Waste Management Permit; G

Project Solid Waste Disposal Documentation Report; G

Hazardous Waste/Debris Management; G

Regulatory Notifications; G

Sales Documentation; G

## 1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

## 1.4.1 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition,



employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

#### 1.5 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements [as required per Contract or Task Order specific to Moody AFB](#) and attached at the end of this section.

#### 1.6 QUALITY ASSURANCE

##### 1.6.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a [Preconstruction Survey](#) of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

##### 1.6.2 [Regulatory Notifications](#)

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications to the Contracting Officer at least 10 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

##### 1.6.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

#### 1.6.4 Employee Training Records

Prepare and maintain [Employee Training Records](#) throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Submit these [Assembled Employee Training Records](#) to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the [Erosion and Sediment Control Inspector Certification](#) as required by state.

#### 1.6.5 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law.

#### 1.7 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after Contract award and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements,

changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

#### 1.7.1 General Overview and Purpose

##### 1.7.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, spill control plan, solid waste management plan, wastewater management plan, air pollution control plan, contaminant prevention plan, [pesticide treatment plan](#), a historical, archaeological, cultural resources, biological resources and wetlands plan, traffic control plan Hazardous, Toxic and Radioactive Waste (HTRW) Plan, borrowing material plan.

##### 1.7.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

##### 1.7.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

##### 1.7.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

##### 1.7.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

#### 1.7.2 General Site Information

##### 1.7.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

##### 1.7.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

#### 1.7.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

#### 1.7.3 Management of Natural Resources

- a. Land resources
- b. Tree protection
- c. Replacement of damaged landscape features
- d. Temporary construction
- e. Stream crossings
- f. Fish and wildlife resources
- g. Wetland areas

#### 1.7.4 Protection of Historical and Archaeological Resources

- a. Objectives
- b. Methods

#### 1.7.5 Stormwater Management and Control

- a. Ground cover
- b. Erodible soils
- c. Temporary measures
  - (1) Structural Practices
  - (2) Temporary and permanent stabilization
- d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

#### 1.7.6 Protection of the Environment from Waste Derived from Contractor Operations

Control and disposal of solid and sanitary waste. Control and disposal of hazardous waste.

This item consist of the management procedures for hazardous waste to be

generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

- a. List of the types of hazardous wastes expected to be generated
- b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated
- c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications
- d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)
- e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)
- f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)
- g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar
- h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures
- i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

#### 1.7.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

#### 1.7.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

#### 1.7.9 Clean Air Act Compliance

##### 1.7.9.1 Haul Route

Submit truck and material haul routes along with a [Dirt and Dust Control Plan](#) for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

##### 1.7.9.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

#### 1.7.9.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

#### 1.7.9.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with 40 CFR 82 requirements. Technicians must be certified, maintain copies of certification on site, use certified equipment and log work that requires the addition or removal of refrigerant. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

#### 1.7.9.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

#### 1.7.9.6 Compliant Materials

Provide the Government a list of SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

### 1.8 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7 Permits and Responsibilities. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

### 1.9 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

### 1.10 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

#### 1.10.1 Monthly Solid Waste Disposal Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

#### 3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

#### 3.1.2 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate

action for trees and other landscape features scarred or damaged by equipment operations.

### 3.1.3 Streams

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the federal, state, and local governments. Construction of stream crossing structures must be in compliance with any required permits including, but not limited to, Clean Water Act Section 404, and Section 401 Water Quality.

The Contracting Officer's approval and appropriate permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

## 3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

### 3.2.1 Construction General Permit

Provide a Construction General Permit as required by [40 CFR 122.26](#) or the State of [Georgia](#) General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

#### 3.2.1.1 Stormwater Pollution Prevention Plan

Submit a project-specific [Stormwater Pollution Prevention Plan](#) (SWPPP) to the Contracting Officer for approval, within 30 days of Contract Award and prior to the commencement of work. The SWPPP must meet the requirements of [40 CFR 122.26](#) and the [Georgia](#) State General Permit for stormwater discharges from construction sites.

Include the following:

- a. Comply with terms of the state general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with state requirements. Use EPA guide [Developing your Stormwater Pollution Prevention Plan](#) located at <https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp> to prepare the SWPPP.
- b. Select applicable BMPs from EPA Fact Sheets located at <https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#constr> or in accordance with applicable state or local requirements.



- c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.

#### 3.2.1.2 Stormwater Notice of Intent for Construction Activities

Prepare and submit the Notice of Intent for NPDES coverage under the general permit for construction activities to the Contracting Officer for review.

Submit the approved NOI and appropriate permit fees onto the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

#### 3.2.1.3 Inspection Reports

Submit "Inspection Reports" to the Contracting Officer in accordance with the State of Georgia Construction General Permit.

#### 3.2.1.4 Stormwater Pollution Prevention Plan Compliance Notebook

Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the the Georgia State Permitting Agency, and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.

### 3.2.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

#### 3.2.2.1 Erosion Control

Prevent erosion by mulching, Compost Blankets, Geotextiles, temporary slope drains. Stabilize slopes by sodding, seeding, or such combination of these methods necessary for effective erosion control. Use of hay bales is prohibited.

Provide seeding in accordance with Section 32 92 19 SEEDING.

#### 3.2.2.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Include the following devices: silt fence, temporary diversion dikes, and/or storm drain inlet protection.

#### 3.2.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

#### 3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

#### 3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

### 3.3 SURFACE AND GROUNDWATER

#### 3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of Georgia water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

#### 3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States.

### 3.4 PROTECTION OF CULTURAL RESOURCES

#### 3.4.1 Archaeological Resources

Existing archaeological resources within the work area are shown on the drawings or Statement of Work. Protect these resources and be responsible for their preservation during the life of the Contract. If, during excavation or other construction activities, any previously unidentified or

unanticipated historical, archaeological, and cultural resources are discovered or found, activities that may damage or alter such resources will be suspended. Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

#### 3.4.2 Historical Resources

Existing historical resources within the work area are shown on the drawings. Protect these resources and be responsible for their preservation during the life of the Contract.

#### 3.5 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards.

##### 3.5.1 Preconstruction Air Permits

Notify the Air Program Manager, through the Contracting Officer, at least 6 months prior to bringing equipment, assembled or unassembled, onto the Installation, so that air permits can be secured. Necessary permitting time must be considered in regard to construction activities. Clean Air Act (CAA) permits must be obtained prior to bringing equipment, assembled or unassembled, onto the Installation.

Confirm that these permits have been obtained.

##### 3.5.2 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat, process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Provide in accordance with paragraph PRECONSTRUCTION AIR PERMITS.

##### 3.5.3 Burning

Burning is prohibited on the Government premises.

##### 3.5.4 Class I and II ODS Prohibition

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the appropriate location for turn in of all reclaimed refrigerant.

##### 3.5.5 Accidental Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer.

#### 3.5.6 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

#### 3.5.7 Dust Control

Keep dust down at all times, including during nonworking periods. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, [29 CFR 1910.1053](#) or [29 CFR 1926.1153](#) for controlling exposure to Crystalline Silica Dust.

##### 3.5.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed [40 CFR 50](#), state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

##### 3.5.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with [29 CFR 1910](#).

#### 3.5.8 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.

### 3.6 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

#### 3.6.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

### 3.7 WASTE MANAGEMENT AND DISPOSAL

#### 3.7.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of [40 CFR 261](#) or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

#### 3.7.2 Solid Waste Management

##### 3.7.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other [sales documentation](#). In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

### 3.7.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

### 3.7.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

#### 3.7.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

#### 3.7.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262.34 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or 1 quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90 day accumulation point be established. Submit a request in writing to the Contracting Officer and provide the following information (Attach Site Plan

to the Request):

Contract QSEU Number	
Contractor	
Haz/Waste or Regulated Waste POC	
Phone Number	
Type of Waste	
Source of Waste	
Emergency POC	
Phone Number	
Location of the Site	

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g. training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.7.3.3 Hazardous Waste Disposal

3.7.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.

3.7.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the hazardous material or waste in accordance with 40 CFR 260, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting or complete waste profile sheets, equipment, and compile documentation).

3.7.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

3.7.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

3.7.3.3.1.4 Labeling

Determine the Department of Transportation's (DOT's) proper shipping names for waste (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262.31 and applicable state or local regulations.

#### 3.7.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

- a. Batteries as described in 40 CFR 273.2
- b. Lamps as described in 40 CFR 273.5
- c. Mercury-containing equipment as described in 40 CFR 273.4

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed.

#### 3.7.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

#### 3.7.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

#### 3.7.4 Releases/Spills of Oil and Hazardous Substances

##### 3.7.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer and the state or local authority.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance



with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

#### 3.7.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

#### 3.7.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

#### 3.7.6 Wastewater

##### 3.7.6.1 Disposal of Wastewater

Disposal of wastewater must be as specified below.

##### 3.7.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction- related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and regulations.

##### 3.7.6.1.2 Surface Discharge

For discharge of ground water, surface discharge in accordance with federal, state, and local laws and regulations.

##### 3.7.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing must be land- applied in accordance with federal, state, and local laws and regulations for land application or discharged into the sanitary sewer with prior approval and notification to the Wastewater Treatment Plant's Operator.

#### 3.8 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities

to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261.

### 3.9 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

### 3.10 CONTROL AND MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM)

Manage and dispose of asbestos- containing waste in accordance with 40 CFR 61. Refer to Section 02 82 00 ASBESTOS REMEDIATION. Manifest asbestos-containing waste and provide the manifest to the Contracting Officer. Notifications to the state and Installation Air Program Manager are required before starting any asbestos work.

### 3.11 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

Manage and dispose of lead-contaminated waste in accordance with 40 CFR 745 and Section 02 83 00 LEAD REMEDIATION. Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.

### 3.12 CONTROL AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBS)

Manage and dispose of PCB-contaminated waste in accordance with 40 CFR 761 and Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBS).

### 3.13 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBS

Manage and dispose of contaminated waste in accordance with 40 CFR 761. Refer to Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY.

### 3.14 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, immediately stop work in that area and immediately inform the Contracting Officer.

### 3.15 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers,

to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of fuel on the project site must be in accordance with EPA, state, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.

#### 3.15.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

#### 3.15.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overflow protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

#### 3.16 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

#### 3.17 CHLORDANE

Evaluate excess soils and concrete foundation debris generated during the demolition of housing units or other wooden structures for the presence of chlordane or other pesticides prior to reuse or final disposal.

#### 3.18 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the

EPA. Blasting or use of explosives are not permitted without written permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, exclusive of holidays, unless otherwise specified.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of Georgia rules.

### 3.19 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

## SECTION 01 74 19

## CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

02/19, CHG 3: 11/21

## PART 1 GENERAL

## 1.1 DEFINITIONS

## 1.1.1 Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

## 1.1.2 Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

## 1.1.3 Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

## 1.1.4 Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill or incinerator, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

## 1.1.5 Diversion

The practice of diverting waste from disposal in a landfill or incinerator, by means of eliminating or minimizing waste, or reuse of materials.

## 1.1.6 Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

## 1.1.7 Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

## 1.1.8 Reuse

The use of a product or materials again for the same purpose, in its original form or with little enhancement or change.

### 1.1.9 Salvage

Usable, salable items derived from buildings undergoing demolition or deconstruction, parts from vehicles, machinery, other equipment, or other components.

### 1.1.10 Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

## 1.2 CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 60 percent by weight of the project construction waste and demolition debris/waste from the landfill or incinerator. Follow applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste. (1) Practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction waste and demolition debris/waste from landfills and incinerators and to facilitate the recycling or reuse of excess construction materials.

## 1.3 CONSTRUCTION WASTE MANAGEMENT

Implement a Construction Waste Management Program for the project. Take a pro-active, responsible role in the management of construction construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the Construction Waste Management Program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

### 1.3.1 Implementation of Construction Waste Management Program

Develop and document how the Construction Waste Management Program will be implemented in a Construction Waste Management Plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

### 1.3.2 Oversight

The Quality Control Manager is responsible for overseeing and documenting results from executing the Construction Waste Management Plan for the project.

### 1.3.3 Special Programs

Implement special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materials. Retain revenue or savings from salvaged or recycling, unless otherwise directed. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by

federal, state, and local regulations.

#### 1.3.4 Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

#### 1.3.5 Waste Streams

Delineate waste streams and characterization, including estimated material types and quantities of waste, in the Construction Waste Management Plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste streams not listed:

- a. Land Clearing Debris
- b. Asphalt
- c. Masonry and CMU
- d. Concrete
- e. Metals (Includes, but is not limited to, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze.)
- f. Wood (nails and staples allowed)
- g. Glass
- h. Paper
- i. Plastics (PET, HDPE, PVC, LDPE, PP, PS, Other)
- j. Gypsum
- k. Non-hazardous paint and paint cans
- l. Carpet
- m. Ceiling Tiles
- n. Insulation
- o. Beverage Containers

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Waste Management Plan; G

## SD-06 Test Reports

Quarterly Reports

Annual Report

## SD-11 Closeout Submittals

Final Construction Waste Diversion Report; S

## 1.5 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding relative to the management of the Construction Waste Management Program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 00.00 10 QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

- a. Preconstruction meeting.
- b. Regular Quality Control meetings.
- c. Work safety meeting (if applicable).

## 1.6 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 15calendar days after notice to proceed. Revise and resubmit Construction Waste Management Plan as necessary, in order for construction to begin. Execute demolition or deconstruction activities in accordance with Section 02 41 00 DEMOLITION. Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved Construction Waste Management Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

- a. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on the project..
- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the regular meetings to be held to address waste management.
- d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.



- e. Name of landfill and incinerator to be used.
- f. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.
- g. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.
- h. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.
- i. Description of the means by which materials identified in item (g) above will be protected from contamination.
- j. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- k. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.

Distribute copies of the waste management plan to each subcontractor, [Quality Control Manager](#) , and the Contracting Officer.

## 1.7 RECORDS (DOCUMENTATION)

### 1.7.1 General

Maintain records to document the types and quantities of waste generated and diverted through re-use, recycling and sale to third parties; through disposal to a landfill or incinerator facility. Provide explanations for materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

### 1.7.2 Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

## 1.8 REPORTS

### 1.8.1 General

[Maintain current construction waste diversion information on site for periodic inspection by the Contracting Officer. Include in the quarterly](#)

reports, annual reports and final reports: the project name, contract information, information for waste generated, diverted and disposed of for the current reporting period and show cumulative totals for the project. Reports must identify quantities of waste by type and disposal method. Also include in each report, supporting documentation to include manifests, weigh tickets, receipts, and invoices specifically identifying the project and waste material type and weighted sum.

#### 1.9 FINAL CONSTRUCTION WASTE DIVERSION REPORT

A Final Construction Waste Diversion Report is required at the end of the project. Provide [Final Construction Waste Diversion Report](#) 10 calendar days prior to the Beneficial Occupancy Date (BOD). The final Construction Waste Diversion Report must be included in the Sustainability eNotebook in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

#### 1.10 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the Construction Waste Management Plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Separate materials by one of the following methods described herein:

##### 1.10.1 Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the Construction Waste Management Plan.

##### 1.10.2 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

#### 1.11 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

##### 1.11.1 Reuse

Give first consideration to reusing construction and demolition materials as a disposition strategy. Recover for reuse materials, products, and components as described in the approved Construction Waste Management Plan. Coordinate with the Contracting Officer to identify onsite reuse opportunities or material sales or donation available through Government resale or donation programs. Sale of recovered materials is not allowed on the Installation. Consider the use of surplus industrial supply broker services, who match entities with reusable or repurpose industrial materials with entities with need of such materials.

#### 1.11.2 Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) -containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

#### 1.11.3 Waste

Dispose by landfill or incineration only those waste materials with no practical use, economic benefit, or recycling opportunity.

### PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

Not used. -- End of Section --

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## SECTION 01 78 00

## CLOSEOUT SUBMITTALS

05/19, CHG 1: 08/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## U.S. ARMY CORPS OF ENGINEERS (USACE)

ERDC/ITL TR-12-1 (2015) A/E/C Graphics Standard, Release 2.0

ERDC/ITL TR-12-6 (2015) A/E/C CAD Standard - Release 6.0

## U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08 (2009; with Change 2, 2011) Criteria for Transfer and Acceptance of DoD Real Property

## 1.2 DEFINITIONS

## 1.2.1 As-Built Drawings

As-built drawings are the marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Contracting Officer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. These files serve as the basis for the creation of the record drawings.

## 1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

## 1.3 SOURCE DRAWING FILES

Request the full set of electronic drawings, in the source format, for Record Drawing preparation, after award and at least 30 days prior to required use.

## 1.3.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction drawings and data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against

the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction drawings and data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-03 Product Data

Warranty Management Plan

Warranty Tags

Spare Parts Data

##### SD-08 Manufacturer's Instructions

Posted Instructions

##### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

##### SD-11 Closeout Submittals

As-Built Drawings; G

Record Drawings; G

As-Built Record of Equipment and Materials

Certification of EPA Designated Items

Interim DD FORM 1354; G

## Checklist for DD FORM 1354; G

## 1.5 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

- a. Indicate manufacturer's name, part number, and stock level required for test and balance, pre-commissioning, maintenance and repair activities. List those items that may be standard to the normal maintenance of the system.

## 1.6 QUALITY CONTROL

Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must conform to ERDC/ITL TR-12-6 and be the same as the original line colors, line weights, lettering, layering conventions, and symbols.

## 1.7 WARRANTY MANAGEMENT

## 1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction. At least 14 calander days before the planned pre-final inspection, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan narrative must contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Submit warranty information, made available during the construction phase, to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period must begin on the date of project acceptance and continue for the full product warranty period. Schedule and conduct a joint warranty inspection, measured from time of acceptance; with the Contractor, Contracting Officer and the Customer Representative. The warranty management plan must include, but is not limited to, the following:

- a. Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.
- b. For each warranty, the name, address, telephone number, and e-mail of each of the guarantor's representatives nearest to the project location.
- c. A list and status of delivery of Certificates of Warranty for extended warranty items, including roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems, such as fire protection and alarm systems, sprinkler systems, and lightning protection systems.
- d. As-Built Record of Equipment and Materials list for each warranted equipment, item, feature of construction or system indicating:

- (1) Name of item.
  - (2) Model and serial numbers.
  - (3) Location where installed.
  - (4) Name and phone numbers of manufacturers or suppliers.
  - (5) Names, addresses and telephone numbers of sources of spare parts.
  - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have warranties longer than one year must be indicated with separate warranty expiration dates.
  - (7) Cross-reference to warranty certificates as applicable.
  - (8) Starting point and duration of warranty period.
  - (9) Summary of maintenance procedures required to continue the warranty in force.
  - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
  - (11) Organization, names and phone numbers of persons to call for warranty service.
  - (12) Typical response time and repair time expected for various warranted equipment.
- e. The plans for attendance at the post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of equipment covered by warranties longer than one year.
- g. Copies of [instructions](#) to be posted near selected pieces of equipment where operation is critical for warranty or safety reasons.

#### 1.7.2 Performance Bond

The Performance Bond must remain effective throughout the construction and warranty period.

- a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
- b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.
- c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.7.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to



the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

#### 1.7.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

- a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
- b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
- c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.
- d. The "Construction Warranty Service Priority List" is as follows:

##### Code 1-Life Safety Systems

- (1) Fire suppression systems.
- (2) Fire alarm system(s) in place in the building.

##### Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

##### Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.
- (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

##### Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

##### Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

## Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

## Code 3-Electrical

Street lights.

## Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

## Code 1-Heat

- (1) Area power failure affecting heat.
- (2) Heater in unit not working.

## Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

## Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

## Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

## Code 3 -Plumbing

Leaky faucets.

## Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

## Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

## Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

## Code 2-Water (Exterior)

No water to facility.

## Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-All other work not listed above.

#### 1.7.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

Prepare the CAD drawing files in AutoCAD Release 2010 or later format compatible with a Windows operating system.

2.1.1 Additional Drawings

If additional drawings are required, prepare them using the specified electronic file format applying ERDC/ITL TR-12-6 and ERDC/ITL TR-12-1. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings.

### 2.1.1.1 Sheet Numbers and File Names

If a sheet needs to be added between two sequential sheets, append a Supplemental Drawing Designator in accordance with ERDC/ITL TR-12-6 Adding a drawing sheet, and ERDC/ITL TR-12-1 Adding or deleting drawing sheets and index sheet procedures.

## 2.2 CERTIFICATION OF USDA DESIGNATED ITEMS

Submit the [Certification of USDA Designated Items](#) as required by FAR 52-223-1 Bio-based Product Certifications and FAR 52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current USDA standards for biobased materials content. The following exemptions may apply to the non-procurement of biobased content materials:

- a. The product does not meet appropriate performance standards;
- b. The product is not available within a reasonable time frame;
- c. The product is not available competitively (from two or more sources);
- d. The product is only available at an unreasonable price (compared with a comparable bio-based content product)."

Record each product used in the project that has a requirement or option of containing biobased content in accordance with SECTION 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (a, b, c, or d, as indicated), and comments. Biobased content values may be determined by weight or volume percent, but must be consistent throughout.

## 2.3 PDF AS-BUILT FILES

Provide electronic PDF "plots" of all contract drawings sheets associated with the as-built drawing submittal. Compile and organize the PDF set to match the contract drawings. Bookmark and label the pages of the PDF file in accordance with Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD).

## 2.4 REDLINES AND MARKUPS

Provide PDFs of the current working redlines and/or markups complying with the as-builts drawing and markup requirements contained in this specification.

## [2.5 GEO-DATA-BASE FILES

Provide a SDSFIE/FGDC GeoReferenced personal GeoDataBase. For all information outside of the building walls, provide a personal GeoDataBase in .mdb format using the latest version of Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) as the database structure. Provide a shell database to define the projection and database structure.

For all drawings within and including the exterior walls, utilize the advanced modeling formats described and referenced herein. Provide a short GeoDataBase read-me file explaining the deliverable. The read-me file will include a description of the software used to create the data, projection, and include the attribute tables used.

### ]2.6 AS-BUILT OR ADVANCED MODELING RE-SUBMISSION REQUIREMENTS

If elements of an as-built submittal or advanced modeling package are rejected, provide the following for each re-submission, in addition to any information required in Section 01 33 00 SUBMITTAL PROCEDURES:

- a. Re-submit all components required under paragraph As-Built or Advanced Modeling Package, including a new Advanced Modeling Submittal Checklist and updated content in response to Government comments.
- b. Provide a copy of all Government review comments.
- c. Provide a disposition/response to each Government review comment for a back-check of the re-submission deliverable.

## PART 3 EXECUTION

### 3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site or red-lined PDF files. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date (BOD).

#### 3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

- a. Use base colors of red, green, and blue. Color code for changes as follows:
  - (1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.
  - (2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.
  - (3) Additions (Green) - Added items, lettering in notes and leaders.
- b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.
- c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.
- d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.

- e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.
- f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.
- g. For deletions, cross out all features, data and captions that relate to that revision.
- h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.
- i. Indicate one of the following when attaching a print or sketch to a markup print:
  - 1) Add an entire drawing to contract drawings
  - 2) Change the contract drawing to show changes on the drawing.
  - 3) Provided for reference only to further detail the initial design.
- j. Incorporate all shop and fabrication drawings into the markup drawings.

### 3.1.1.2 As-Built Drawings Content

Revise As-Built Drawings or red-lined PDF files in accordance with ERDC/ITL TR-12-1 and ERDC/ITL TR-12-6. Keep these working as-built markup drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract drawings which are made during construction or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Submit the working as-built markup drawings for approval prior to submission of each monthly pay estimate. For failure to maintain the working and final record drawings as specified herein, the Contracting Officer may withhold 10 percent of the monthly progress payment until approval of updated drawings. Show on the as-built drawings, but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.
- b. The location and dimensions of any changes within the building structure.
- c. Layout and schematic drawings of electrical circuits and piping.
- d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from

contract plans.

- e. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.
- f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- g. Changes or Revisions which result from the final inspection.
- h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.
- i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.
- j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- k. Changes in location of equipment and architectural features.
- l. Modifications.
- m. Actual location of anchors, construction and control joints, etc., in concrete.
- n. Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- o. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

### 3.2 RECORD DRAWING FILES

If additional drawings are required, prepare them using the specified electronic file format applying ERDC/ITL TR-12-6 and ERDC/ITL TR-12-1. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CAD files. Provide all program files and hardware necessary to prepare final PDF record drawings. The Contracting Officer will review final PDF record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

#### 3.2.1 Rename the CAD Drawing files

Rename the CAD Drawing files using the contract number as the Project Code field, (e.g., W91238-15-C-10A-102.DWG) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. Make all changes on the layer/level as the original item.

- a. For AutoCAD files (DWG), enter all as-built delta changes and notations on the AS-BUILT layer.

- b. When final revisions have been completed, show the wording "RECORD DRAWING AS-BUILTS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Date RECORD DRAWING AS-BUILTS" drawing revisions in the revision block.
- c. Within 10 days after Government approval of all of the working record drawings for a phase of work, prepare the final CAD record drawings for that phase of work and submit PDF drawing files and two sets of prints for review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 7 days revise the CAD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 10 days of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic CAD files, and one set of the approved working record PDF and or programfiles with two sets of prints. The CAD files must be complete in all details and identical in form and function to the CAD drawing files supplied by the Government. Prepare AutoCAD files for transmittal using e-Transmit. Make any transactions or adjustments necessary to accomplish this. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CAD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record PDF drawing files, CAD files and marked prints as specified will be cause for withholding any payment due under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made.

### 3.3 RECORD DRAWINGS

Prepare final record drawings after the completion of each definable phase of work as listed in the Contractor Quality Control Plan (such as Foundations, Utilities, or Structural Steel as appropriate for the project). Transfer the changes from the approved working as-built markup drawings to the original electronic CAD drawing files. Modify the as-built CAD drawing files to correctly show the features of the project as-built by bringing the working CAD drawing set into agreement with approved working as-built markup drawings, and adding such additional drawings as may be necessary. Refer to ERDC/ITL TR-12-1. Jointly review the working as-built markup drawings with printouts from working as-built CAD drawing PDF files for accuracy and completeness. Monthly review of working as-built CAD drawing PDF file printouts must cover all sheets revised since the previous review. These PDF drawing files are part of the permanent records of this project. Any drawings damaged or lost must be satisfactorily replaced at no expense to the Government.

Drawing revisions (include within change order price the cost to change working and final record drawings to reflect revisions) and compliance with the following procedures.

- a. Follow directions in the revision for posting descriptive changes.
- b. The revision delta size must be 5/16 inch unless the area where the delta is to be placed is crowded. Use a smaller size delta for crowded areas.
- c. Place a revision delta at the location of each deletion.
- d. For new details or sections which are added to a drawing, place a



revision delta by the detail or section title.

- e. For minor changes, place a revision delta by the area changed on the drawing (each location).
- f. For major changes to a drawing, place a revision delta by the title of the affected plan, section, or detail at each location.
- g. For changes to schedules or drawings, place a revision delta either by the schedule heading or by the change in the schedule.

### 3.3.1 Final Record Drawing Package

Submit the final record PDF and CAD drawings package for the entire project within 20 days of substantial completion of all phases of work. Submit one set of ANSI D size PDF and CAD files, two sets of ANSI D size prints and one set of the approved working record drawings. The package must be complete in all details and identical in form and function to the contract drawing files supplied by the Government.

### 3.4 CONSTRUCTION CONTRACT SPECIFICATIONS

Submit final PDF file record construction contract specifications, including revisions thereto, 30 days after transfer of the completed facility.

### 3.5 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide electronic copies of the Operation and Maintenance Manual files and one hard copy of the Operation and Maintenance Manuals. Submit to the Contracting Officer for approval within 14 calendar days of the Beneficial Occupancy Date (BOD). Update and resubmit files for final approval at BOD.

### 3.6 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site..

### 3.7 REAL PROPERTY RECORD

Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354.

#### 3.7.1 Interim DD FORM 1354

Near the completion of Project complete and submit an accounting of all installed property with Interim DD FORM 1354. Include any additional assets, improvements, and alterations from the Draft DD FORM 1354.

#### 3.7.2 Completed DD FORM 1354

For convenience, a blank fillable PDF DD FORM 1354 may be obtained at the following link:

[www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf](http://www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf)

Submit the completed Checklist for DD FORM 1354 of Installed Building Equipment items. Attach this list to the updated DD FORM 1354.

-- End of Section --

## SECTION 01 78 23

## OPERATION AND MAINTENANCE DATA

08/15, CHG 2: 08/21

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-10 Operation and Maintenance Data

O&amp;M Database; G

Training Plan; G

Training Outline; G

Training Content; G

## SD-11 Closeout Submittals

Training Video Recording; G

Validation of Training Completion; G

## 1.2 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

## 1.2.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

## 1.2.2 Package Content

Provide data package content in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Use Data Package 5 for commissioned items without a specified data package requirement in the individual technical sections.

### 1.2.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

## 1.3 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked operation and maintenance directory.

### 1.3.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI MasterFormat numbering system, and arrange submittals using the specification sections as a structure. Use CSI MasterFormat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

### 1.3.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

- a. Building Number
- b. Project Title
- c. Activity and Location
- d. Construction Contract Number
- e. Prepared For: (Contracting Agency)
- f. Prepared By: (Name, title, phone number and email address)
- g. Include the disk content on the disk label
- h. Date
- i. Virus scanning program used

## 1.4 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

### 1.4.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

#### 1.4.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

#### 1.4.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

#### 1.4.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

#### 1.4.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

#### 1.4.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

#### 1.4.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

#### 1.4.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

#### 1.4.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

#### 1.4.1.9 Additional Requirements for HVAC Control Systems

Provide Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

- b. Full as-built sequence of operations.
- c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).
- d. Full points list. Provide a listing of rooms with the following information for each room:
  - (1) Floor
  - (2) Room number
  - (3) Room name
  - (4) Air handler unit ID
  - (5) Reference drawing number
  - (6) Air terminal unit tag ID
  - (7) Heating or cooling valve tag ID
  - (8) Minimum cfm
  - (9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.
- f. Full as-built print out of software program.
- g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

#### 1.4.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

##### 1.4.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

##### 1.4.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance,

inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

- a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

#### 1.4.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs.

##### 1.4.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

##### 1.4.3.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

##### 1.4.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

##### 1.4.3.4 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a

combination of text and illustrations.

#### 1.4.3.5 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

#### 1.4.3.6 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

#### 1.4.4 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

##### 1.4.4.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

##### 1.4.4.2 Certificates

Provide a copy of SD-07 Certificates submittals documented with the required approval.

##### 1.4.4.3 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

##### 1.4.4.4 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

##### 1.4.4.5 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.



#### 1.4.4.6 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.4.4.7 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.4.4.8 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.4.4.9 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

#### 1.4.4.10 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

#### 1.4.4.11 Field Test Reports and Manufacturer's Field Reports

Provide a copy of Field Test Reports (SD-06) and Manufacturer's Field Reports (SD-09) submittals documented with the required approval.

#### 1.4.4.12 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

### 1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

#### 1.5.1 Data Package 1

- a. Safety precautions and hazards

- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Warranty information
- e. Extended warranty information
- f. Contractor information
- g. Spare parts and supply list

#### 1.5.2 Data Package 2

- a. Safety precautions and hazards
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan, schedule, and procedures
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Extended warranty information
- m. Contractor information

#### 1.5.3 Data Package 3

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Operating log
- h. Lubrication data

- i. Preventive maintenance plan, schedule, and procedures
  - j. Cleaning recommendations
  - k. Troubleshooting guides and diagnostic techniques
  - l. Wiring diagrams and control diagrams
  - m. Maintenance and repair procedures
  - n. Removal and replacement instructions
  - o. Spare parts and supply list
  - p. Product submittal data
  - q. O&M submittal data
  - r. Parts identification
  - s. Warranty information
  - t. Extended warranty information
  - u. Testing equipment and special tool information
  - v. Testing and performance data
  - w. Contractor information
  - x. Field test reports
- 1.5.4 Data Package 4
- a. Safety precautions and hazards
  - b. Operator prestart
  - c. Startup, shutdown, and post-shutdown procedures
  - d. Normal operations
  - e. Emergency operations
  - f. Operator service requirements
  - g. Environmental conditions
  - h. Operating log
  - i. Lubrication data
  - j. Preventive maintenance plan, schedule, and procedures
  - k. Cleaning recommendations
  - l. Troubleshooting guides and diagnostic techniques
  - m. Wiring diagrams and control diagrams

- n. Repair procedures
  - o. Removal and replacement instructions
  - p. Spare parts and supply list
  - q. Repair work-hours
  - r. Product submittal data
  - s. O&M submittal data
  - t. Parts identification
  - u. Warranty information
  - v. Extended warranty information
  - w. Personnel training requirements
  - x. Testing equipment and special tool information
  - y. Testing and performance data
  - z. Contractor information
  - aa. Field test reports
- 1.5.5 Data Package 5
- a. Safety precautions and hazards
  - b. Operator prestart
  - c. Start-up, shutdown, and post-shutdown procedures
  - d. Normal operations
  - e. Environmental conditions
  - f. Preventive maintenance plan, schedule, and procedures
  - g. Troubleshooting guides and diagnostic techniques
  - h. Wiring and control diagrams
  - i. Maintenance and repair procedures
  - j. Removal and replacement instructions
  - k. Spare parts and supply list
  - l. Product submittal data
  - m. Manufacturer's instructions
  - n. O&M submittal data

- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information
- r. Extended warranty information
- s. Testing and performance data
- t. Contractor information
- u. Field test reports
- v. Additional requirements for HVAC control systems

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

#### 3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the Quality Control Manager (QC) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and QC. Include within the plan the following elements:

- a. Equipment included in training
- b. Intended audience
- c. Location of training
- d. Dates of training
- e. Objectives
- f. Outline of the information to be presented and subjects covered including description
- g. Start and finish times and duration of training on each subject
- h. Methods (e.g. classroom lecture, video, site walk-through, actual

operational demonstrations, written handouts)

- i. Instructor names and instructor qualifications for each subject
- j. List of texts and other materials to be furnished by the Contractor that are required to support training
- k. Description of proposed software to be used for video recording of training sessions.

### 3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The QC is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. Relevant health and safety issues.
- c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- d. Design intent.
- e. Use of O&M Manual Files.
- f. Review of control drawings and schematics.
- g. Interactions with other systems.
- h. Special maintenance and replacement sources.
- i. Tenant interaction issues.

### 3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

### 3.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

### 3.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

#### 3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

-- End of Section --

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## SECTION 02 32 13

## SUBSURFACE DRILLING AND SAMPLING

02/21

## PART 1 GENERAL

## 1.1 UNIT PRICES

Make all measurements for payment by or in the presence of the Contracting Officer. Preserve all holes in good condition until final measurement and until the records and samples have been examined and accepted. Payment will be made only for drilling and pressure testing those holes or for excavating those test pits that are included in the SCHEDULE OF DRILLING, SAMPLING, AND TESTING, or are directed by the Contracting Officer to be so drilled or excavated. Payment will not be made for any hole or testing for which satisfactory records (and samples), as determined by the Contracting Officer, are not furnished.

## 1.1.1 Mobilization and Demobilization

## 1.1.1.1 Payment

Payment will be made for costs associated with mobilization and demobilization. Sixty percent of the Mobilization and Demobilization lump sum price will be paid following completion of moving onto the site, including complete assembly in working order, of all equipment necessary to perform the required drilling, sampling, pressure-testing and test pit excavation operations. The remaining 40 percent of the contract lump sum price will be paid after all site restoration is completed and all equipment has been removed from the site. No separate payment will be made for moves between holes or test pits.

## 1.1.1.2 Unit of Measure

Unit of measure: lump sum.

## 1.1.2 Auger Boring and Sampling of Drill Holes

## 1.1.2.1 Payment

Payment will be made for costs associated with Auger Boring and Sampling, 4 inch Diameter Drill Holes.

## 1.1.2.2 Measurement

Auger Boring and Sampling, 4 inch Diameter Drill Holes will be measured for payment to the nearest linear foot, based upon the linear feet of holes that were actually drilled through overburden with augers in accordance with the specifications. Measurements will be made from the original ground surface.

## 1.1.2.3 Unit of Measure

Unit of measure: linear foot.

## 1.1.3 Drive Sample Boring and Sampling

## 1.1.3.1 Payment

Payment will be made for costs associated with Drive Sample Boring and Sampling, -4 inch Diameter Samples.

## 1.1.3.2 Measurement

Drilling for drive sample boring and sampling will be measured for payment to the nearest linear foot, based upon the linear feet of holes that were actually drilled by drive-sample-boring methods in accordance with the specifications. Measurements will be made from the original ground surface.

## 1.1.3.3 Unit of Measure

Unit of measure: linear foot.

## 1.1.4 Undisturbed Sample Boring and Sampling

## 1.1.4.1 Payment

Payment will be made for costs associated with Undisturbed Sample Boring and Sampling, 4 inch Diameter Samples.

## 1.1.4.2 Measurement

Drilling for undisturbed sample boring and sampling will be measured for payment to the nearest foot, based upon the linear feet of holes that were actually drilled by undisturbed sampling methods in accordance with the specifications. Measurements will be made from the original ground surface.

## 1.1.4.3 Unit of Measurement

Unit of measure: linear foot.

## 1.1.5 Core Hole Overburden Drilling, Without Sampling

## 1.1.5.1 Payment

Payment will be made for costs associated with Core Hole Overburden Drilling, Without Sampling, 4 inch Diameter Drill Holes, [Vertical] [Inclined].

## 1.1.5.2 Measurement

Core hole drilling through overburden in order to permit core drilling of rock for vertical holes where sampling of overburden is not required will be measured for payment to the nearest foot, based upon the linear feet of hole actually drilled and cased in accordance with these specifications.

## 1.1.5.3 Unit of Measure

Unit of measure: linear foot.

## 1.1.6 Core Drilling, [Vertical] Holes

## 1.1.6.1 Payment

Payment will be made for costs associated with Core Drilling Vertical Holes for 4 inch Diameter Cores.

## 1.1.6.2 Measurement

Core Drilling [Vertical] [Inclined] Holes for 4 inch Diameter Cores will be measured for payment to the nearest foot, based upon the linear feet of hole actually drilled in rock in accordance with the specifications.

## 1.1.6.3 Unit of Measure

Unit of measure: linear foot.

## 1.1.7 Pressure Testing (Hydraulic)

## 1.1.7.1 Payment

Payment will be made for costs associated with Pressure Testing (Hydraulic).

## 1.1.7.2 Measurement

Pressure Testing (Hydraulic) will be measured for payment based upon the number of hours that pressure testing (hydraulic) was actually performed at the direction of the Contracting Officer and in accordance with the specifications or as otherwise required. Pressure testing (hydraulic) will be measured from the time the pressure testing is begun at the direction of the Contracting Officer to the time of completion of the test as determined by the Contracting Officer. Time spent in placing packer elements in the holes, raising or lowering the packer elements from one lift to another, or removing the packer elements from the holes and time spent in preparation for testing will not be included.

## 1.1.7.3 Unit of Measure

Unit of measure: hour.

## 1.1.8 Test Pit Excavation

## 1.1.8.1 Payment

Payment will be made for costs associated with excavating test pits in accordance with [this section] Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

## 1.1.8.2 Measurement

Test Pit Excavation will be measured for payment based upon the contract unit price for each test pit excavated, which includes the cost of all shoring materials.

## 1.1.8.3 Unit of Measure

Unit of measure: each.

## 1.1.9 Test Pit Undisturbed Sample

## 1.1.9.1 Payment

Payment will be made for costs associated with undisturbed sampling in a test pit in accordance with Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

## 1.1.9.2 Measurement

Test Pit Undisturbed Sample will be measured for payment based upon the contract unit price for each sample obtained.

#### 1.1.9.3 Unit of Measure

Unit of measure: each.

#### 1.1.10 Material for Shoring/Lining Pit Excavation

##### 1.1.10.1 Payment

Payments will be made for costs associated with Shoring/Lining Test Pit Excavations at the contract unit price for each test pit excavation.

##### 1.1.10.2 Measurement

Material used for shoring/lining test pit excavations will be measured for payment based upon the amount of material actually used as directed by the Contracting Officer for shoring/lining the excavations. Material salvaged and re-used at the direction of the Contracting Officer will be paid for at the rate of 30 percent of the contract unit price.

##### 1.1.10.3 Unit of Measure

Unit of measure: each.

#### 1.1.11 Casing Left in Drill Holes

##### 1.1.11.1 Payment

Payment will be made for costs associated with Casing Left in Drill Holes, 4 inch Diameter.

##### 1.1.11.2 Measurement

Casing Left in Drill Holes will be measured for payment to the nearest foot, based upon the linear feet of casing actually left in the drill holes at the direction of the Contracting Officer.

##### 1.1.11.3 Unit of Measure

Unit of measure: linear foot.

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### ASTM INTERNATIONAL (ASTM)

ASTM D2113	(2014) Rock Core Drilling and Sampling of Rock for Site Investigation
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D2488

(2017; E 2018) Standard Practice for  
Description and Identification of Soils  
(Visual-Manual Procedure)

### 1.3 SYSTEM DESCRIPTION

Provide the data to determine the type, nature, and characteristics of subsurface materials and the extent and conditions of the various materials as they exist to the depths and at the locations specified. This is to be accomplished by means of core drilling .

#### 1.3.1 Auger Borings and Sampling

An auger boring is any boring made in unconsolidated soils with a conventional manually or power-driven earth auger for the purpose of obtaining samples of subsurface materials. Perform auger boring and sampling in accordance, as directed by the Contracting Officer.

#### 1.3.2 Drive Sample Borings and Sampling

A drive sample boring is a boring made through unconsolidated or partly consolidated sediments or decomposed rock by means of a mechanically driven sampler. The purpose of these borings is to obtain knowledge of the composition, the thickness, the depth, the sequence, the structure, and the pertinent physical properties of foundation or borrow materials. Perform drive sample boring and sampling in accordance with as directed by the Contracting Officer.

#### 1.3.3 Undisturbed Sample Borings and Sampling

An undisturbed sample boring is a boring made to obtain soil samples which, when tested, will show properties as close to the in situ (in place) properties as any sample which can be obtained. Accomplish all undisturbed sampling as directed by the Contracting Officer.

#### 1.3.4 Core Drilling

Provide core drilling consisting with a 4 inch Diameter. Core Drilling of cores must be by any approved standard and accepted method of rotary rock core drilling that will provide continuous and complete rock cores of the required diameter from any subsurface interval of bedrock specified for investigation performed in accordance with ASTM D2113. Provide equally good recovery of cores from both hard and soft rocks.

#### 1.3.5 Pressure Testing (Hydraulic)

Hydraulic pressure testing is the process of forcing water under pressure into subsurface rock formations through pre-drilled holes for the purpose of determining the subsurface leakage conditions and possible grouting requirements.

#### 1.3.6 Test Pit Excavation and Sampling

A test pit is any excavation in soil, hardpan, decomposed rock, or other unconsolidated or partially consolidated overburden materials which has an open cross-sectional area large enough to permit efficient excavation and shoring/lining, engineering and geological inspection and photographing of the subsurface soils and manual undisturbed sampling from within the test

pit. Excavate, dewater (if necessary), shore/line and protect all test pits from surface water drainage in accordance with all applicable Federal, State, local, Corps of Engineers, and OSHA safety regulations.

1.3.7 Sequencing and Scheduling

1.3.7.1 Schedule of Drilling, Sampling, and Testing

Prior to starting work, submit a plan for drilling, sampling, testing, and safety which includes, but is not limited to, the proposed method of drilling and sampling including a description of the equipment and sampling tools that will be used, a listing of any subContractors to include a description of how the subContractors will be used and a description of all methods and procedures that will be utilized to insure a safe operation and to protect the environment. Do not perform any work until this plan has been approved and no deviation from the approved plan will be permitted without prior approval by the Contracting Officer. The schedule of Drilling, Sampling, and Testing is listed in the following schedule:

SCHEDULE OF DRILLING, SAMPLING AND TESTING				
[HOLE NO.] [PIT NO.]	METHOD	DEPTH (FEET)	VERTICAL OR INCLINED	SPECIAL INSTRUCTIONS

1.3.7.2 Order of Work

The order in which the work is to be accomplished will be determined in the field by the Contracting Officer.

1.3.7.2.1 Numerical Sequence

It is intended that the drilling be accomplished in the numerical sequence indicated in the listed in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING; however, the Contracting Officer may vary the order whenever and in whatever manner is deemed best for accomplishing the work.

1.3.7.2.2 Reporter

Provide a qualified, licensed Geologist experienced in subsurface exploration for each drill unit to oversee all drilling, sampling, and field testing operations. This individual is responsible for the preparation of a separate log and/or report for each boring, pressure test, or test pit. This individual is also responsible for the preparation of all soil and rock samples for delivery to the designated point.

1.3.7.2.3 Government Oversight

The presence of a Government representative or the keeping of separate drilling records by the Contracting Officer does not relieve the Contractor of the responsibility for the work specified in this specification.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Drilling Log; G

##### SD-03 Product Data

Permits, Certifications, and Licenses  
Schedule of Drilling, Sampling, and Testing; G

#### 1.5 QUALITY ASSURANCE

Comply with all Federal, State and local laws, regulations and ordinances relating to the performance of this work. Procure all required [permits, certifications and licenses](#) required by Federal, State, and local law for the execution of this work. Submit copies of all permits, certifications, and licenses prior to starting work. Include a statement of the prior experience, in the type of work described in these specifications, of the person or persons designated to perform the work specified herein.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

##### 1.6.1 General

The Contractor is solely responsible for preserving all samples in good condition. Keep samples from freezing and undue exposure to the weather. Keep all descriptive labels and designations on sample jars, tubes, and boxes clean and legible until final delivery of samples to, and acceptance by, the Contracting Officer. Except as otherwise specified, deliver samples to [the qualified testing lab](#). Deliver samples within the time limits specified for each type of investigation or in accordance with schedules prepared by the Contracting Officer.

##### 1.6.2 Undisturbed Samples

Take every precaution to avoid damage to samples as a result of careless handling and undue delay in shipping. Ship samples in containers approved by the Contracting Officer. Provide durable containers to protect the samples from any damage during shipment. Pack the sample tubes in vermiculite or other equal material approved by the Contracting Officer to protect the samples against vibration. Avoid exposing sealed and crated samples to precipitation, direct sunlight, freezing and temperatures in excess of [100 degrees F](#). Replace frozen, as well as partially frozen, samples. In general, undisturbed samples are not allowed to remain on the site of sampling for more than one week before shipment. Store and ship samples with the tube in a vertical position in order to prevent consolidation and segregation or change of water content.

#### 1.7 PROJECT/SITE CONDITIONS

##### 1.7.1 Environmental Requirements

Comply with Section [01 57 19](#) TEMPORARY ENVIRONMENTAL CONTROLS. In order to

prevent and to provide for abatement and control of any environmental pollution arising from Contractor activities in the performance of this contract, the Contractor and its subContractors must comply with all applicable Federal, State, and local laws, regulations, and ordinances concerning environmental pollution control and abatement.

- a. The Contractor is responsible for keeping informed of all updates and changes in all applicable laws, regulations, and ordinances.
- b. Do not pollute lakes, ditches, rivers, springs, canals, waterways, groundwaters, or reservoirs with drill fluids, fuels, oils, bitumens, calcium chloride, insecticides, herbicides, or other materials that may be harmful to the environment or a detriment to outdoor recreation.

#### 1.7.2 Field Measurements

The approximate locations of drill holes are shown on the attached drawings. The actual locations will be established in the field by the Contracting Officer prior to the start of work. The elevations of the established locations will also be provided by the Contracting Officer prior to the start of work. Provide access to the locations as necessary for the prosecution of the work. Since no separate payment will be made for access construction, include all costs associated with this in the cost of drilling.

### PART 2 PRODUCTS

#### 2.1 CONTAINERS

Furnish jars, tubes, and boxes that meet the following requirements. All such containers will become the property of the Government and the cost thereof will be included in the contract price for the applicable item for which payment is provided.

##### 2.1.1 Sample Jars

Provide sample jars that are 1 quart capacity, wide-mouth over 2-1/4 inches in diameter plastic jars with moisture-tight screw tops.

##### 2.1.2 Shipping Boxes

Provide corrugated cardboard boxes that have the capacity to hold no more than 12 sample jars and the strength to contain and protect the jars and their contents under ordinary handling and environmental conditions.

##### 2.1.3 Tubes and Crates

Ship undisturbed samples in thin walled Shelby tubes packed in crates.

##### 2.1.4 Core Boxes

Use longitudinally partitioned, hinged top, wooden core boxes constructed of plywood and dressed lumber or other approved materials in general accordance with the arrangement and dimensions shown in FIGURE 1 for all rock cores. Use as many core boxes as required to box all core. Furnish core boxes completely equipped with all necessary partitions, hinges, and a hasp for holding down the cover. Also provide wood spacers made of surfaced lumber (not plywood) and having dimensions that are 1/8 inch less than the inside dimensions of the individual core box troughs and no less



than 3/4 inch thick for blocking the core in the boxes and for providing a marking space to identify core runs and pull depths/elevations. The quantities of these blocks that are required are: ten blocks per core box for 3 inch or smaller core, five blocks per core box for 4 inch and PQ core, and three blocks per core box for 6 inch core. The box should have the following capacities:

Box Capacities	
6-inch core	single row of core
4-inch or PQ core	2 rows of core
3-inch or smaller core	3 or 4 rows of core

Provide core box with a maximum length of 4 feet for 3 inch or smaller core and dimensioned so that a box will hold 12 to 16 feet of core. The maximum length of a core box for core that is larger than 3 inches must be 5 feet.

2.2 LABELS

2.2.1 Sample Jar Labels

Affix a printed or type-written, fade resistant and waterproof label to the outside of each jar containing the following information:

PROJECT	(such as Table Rock Dam)	LOCATION	(such as Borrow Area B)
HOLE NO.		STATION	
JAR NO.		of	_____ JARS
TOP ELEVATION OF		DEPTH OF SAMPLE	
DESCRIPTION OF MATERIAL	(such as moist, silty, medium sand)		

2.2.2 Shipping Box Labels

Identify each box of jar samples with weatherproof and wear-proof labels indicating the following:

PROJECT	[_____]
LOCATION	
JAR SAMPLES FROM HOLE OR HOLES	

2.2.3 Core Box Labels

Identify core boxes with stenciled labels containing the following information:

PROJECT	[_____]
HOLE NO.	
BOX NO.	
TOTAL NUMBER OF BOXES FOR THE HOLE	

2.3 EQUIPMENT AND SUPPLIES

2.3.1 Auger Boring and Sampling

Furnish the equipment for making auger borings including, but not limited to, standard continuous flight augers and/or standard cup-type earth augers, similar or equal to the Iwan Auger and not less than 4 inches in diameter unless otherwise approved. Equip augers with all the accessories necessary for boring and sampling of overburden materials to the depths and diameters specified or shown on the drawings.

2.3.2 Drive Sample Boring and Sampling

Furnish equipment for making drive sample borings including, but not limited to, standard 2-inch OD drive samplers and power-driven drilling machinery of a type or types approved by the Contracting Officer, in the schedule in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING. Provide hardened steel drive shoe for the split barrel samplers and replace or repair when it becomes dented or distorted. Include all casing, drill stem, drill bits, drill fluid and additives, pumps, and power necessary to accomplish the required boring and sampling.

2.3.3 Undisturbed Sample Boring and Sampling

Furnish equipment for making undisturbed sample borings including, but not limited to, power-driven drilling machinery of an approved type or types complete with the special devices and accessories enumerated and described hereinafter. Provide hydraulic feed type drilling machinery. Include all samplers, casing, drill stem, drill bits, drill fluid and additives, pumps, and power necessary to accomplish the required boring and sampling. Provide drill casing, if used, of such minimum inside diameter as to allow use of the selected sampler.

2.3.3.1 Sands and Cohesive Soils

Subject to the approval of the Contracting Officer, floating or free piston and non-piston type samplers may be used provided adequate means, such as check valve or vacuum system, are provided to prevent loss of samples.

2.3.3.2 Stiff and Dense Soils

Provide sampling device for obtaining samples of stiff and dense soils similar or equal to a Denison double tube, swivel head core barrel, or a Pitcher sampler and approved by the Contracting Officer prior to use.

2.3.4 Core Drilling

Provide core drilling consisting of a 4 inch Diameter Core. Furnish equipment for core drilling including core-drilling machinery of a type or types approved by the Contracting Officer, complete with all the accessories needed to take continuous rock cores of a diameter consistent with bit size to the depths specified. Use, as a minimum, a standard ball-bearing, swivel-head, double-tube core barrel, or equivalent. Capacity of the core barrel exceeding 10.5 feet of core is not acceptable. Include all casing, drill rods, core barrels, coring bits, piping, pumps, water, tools, and power required for drilling and all boxes and containers required for core samples. Selection of the type of bit is at the Contractor's discretion provided that the selected bit produces high quality rock core (see paragraph SUPPLEMENTAL BORINGS).

### PART 3 EXECUTION

#### 3.1 MOBILIZATION AND DEMOBILIZATION

##### 3.1.1 Mobilization

Mobilization consists of the delivery to the site of all plant, equipment, materials and supplies to be furnished by the Contractor, the complete assembly in satisfactory working order of all such plant and equipment at the jobsite and the satisfactory storage at the site of all such materials and supplies.

##### 3.1.2 Demobilization

Demobilization consists of the removal from the site of all plant, equipment, materials and supplies after completion of the work and also includes, at the direction of the Contracting Officer, the cleanup and removal of all scrap, waste backfill material, waste drilling fluid, soil contaminated with engine/hydraulic oil, backfilling all sumps or excavations resulting from the operations and, in general, returning the site as close to its original condition as possible.

#### 3.2 IDENTIFYING SAMPLES

Provide sample jars, shipping boxes, and labels that comply with PART 2, paragraphs SAMPLE JARS, SHIPPING BOXES, and LABELS, respectively. [In addition, place a moisture proof label containing the project name, hole number and sample number inside the jar or write this information using a waterproof pen or scribe on the jar lid.] Take all precautions required to insure that the shipping boxes are not subjected to rough handling or damaging environmental conditions [, and complies with paragraph CARE AND DELIVERY OF SAMPLES]. [Enclose a copy of the boring log for the portion of the boring that the samples came from in the shipping box.]

#### 3.3 AUGER BORING AND SAMPLING

Label samples in accordance with paragraph IDENTIFYING SAMPLES. Obtain samples for each change of overburden material and at maximum vertical intervals of 5 or as directed by the Contracting Officer. In order to retain the natural moisture content of the material to the fullest extent possible, provide samples of sufficient volume to completely fill the sample jars and place the samples in the sample jars as soon as possible after they are taken from the hole. Label all sample jars. In general, no sample is allowed to remain on the site of boring for more than 1 week after being taken from the boring and placed in a jar.

### 3.4 DRIVE SAMPLE BORING AND SAMPLING

Label samples in accordance with paragraph IDENTIFYING SAMPLES. Case drive sample borings drilled through overburden materials to permit obtaining drive samples of the size or sizes specified or as directed. Take samples continuously or at maximum vertical intervals of 5 feet or at a change in materials [in accordance with instructions contained in the SCHEDULE OF DRILLING, SAMPLING, AND TESTING] [as shown on the drawings] or as otherwise directed by the Contracting Officer. Drive the sampler with the force of the 140 pound drive hammer under a free fall of [\_\_\_\_\_] inches. To minimize the compacting effect of casing driving when casing is used to stabilize a boring, keep the bottom of the casing as high above the soil sampling zone as conditions permit. If hollow stem auger is used as a casing and/or to advance the boring, a plug assembly must be used to keep soil from entering the inside of the auger. Above the water table, obtain samples from a dry hole. Below the water table, maintain water within the hole at or above the groundwater level. Where information on the natural water content of soils above the water table is not needed and when approved by the Contracting Officer, boreholes may be drilled without casing by using a suitable drilling fluid to prevent collapse of sidewalls. When a drilling fluid is used, perform soil sampling by such means that will prevent inclusion of drilling fluid in the samples. Place the samples in sample jars as soon as possible after they are taken from the hole and, when possible, the volume of the sample must be large enough to completely fill the sample jar in order that the natural moisture content of the material may be retained to the fullest extent possible. Label all samples. No sample is permitted to remain at the site of boring for more than one week after being taken from the hole.

### 3.5 UNDISTURBED SAMPLE BORING AND SAMPLING

In general, label undisturbed samples in conformance to paragraph IDENTIFYING SAMPLES. Take particular care to indicate the top and bottom of each sample tube. Label tubes and crates for undisturbed samples "DO NOT JAR OR VIBRATE" and "HANDLE, HAUL, AND SHIP IN A VERTICAL POSITION".

#### 3.5.1 Procedure

The procedure for Undisturbed Sample Boring and Sampling is outlined in paragraph DRIVE SAMPLE BORING AND SAMPLING, except that the sampling device must be advanced downward by one continuous, smooth drive using the drill rig's hydraulic feed system. Read and record the hydraulic down pressure at 6 inch intervals during each sample drive. Advance the sampling device for stiff and dense soils by continuous rotation of the outer cutting barrel in conjunction with use of drill fluid circulation. Driving of any undisturbed sampling device by means such as a drop hammer will not be permitted.

#### 3.5.2 Sealing

##### 3.5.2.1 Alternate 1

Retain the soil sample obtained in a thin wall Shelby tube in the tube and sealed on both ends with a mechanically expandable O-ring sealing disk of the appropriate size.

##### 3.5.2.2 Alternate 2

Extrude the soil sample obtained in a thin wall Shelby tube from the tube

in the field as soon as the tube is removed from the boring by a method approved by the Contracting Officer.

### 3.6 CORE HOLE OVERBURDEN DRILLING

Where samples of overburden materials are required in connection with core drilling, drill and sample the soil overburden in accordance with the applicable provisions for the type of samples required.

### 3.7 CORE DRILLING

Provide core drilling consisting of a 4 inch Diameter Core

#### 3.7.1 Procedure

Drill all holes vertically to the bottom elevations or depths specified unless indicated in the schedule of borings or directed to be drilled otherwise. Off-setting of borings from the locations specified in the Plan of Borings or as shown on the drawings, will not be permitted without prior approval. Casing through the overburden may be required. Seal this casing in the rock at the elevation where rock is encountered prior to commencement of rock coring. Operate the drills at required speeds and down pressures to control drill fluid pressures and quantities to insure maximum core quality and recovery in whatever kind of rock is encountered. Where soft or broken rock is encountered, reduce the length of runs to 5 feet or less in order to reduce and/or keep core loss and core disturbance to the minimum. Failure to comply with the foregoing procedures will constitute justification for the Contracting Officer to require redrilling, at the Contractor's expense, of any boring from which the core recovery is unsatisfactory. Exercise particular care in recording zones of water loss, cavities, rod jerks, rough drilling and other unusual and non-ordinary coring experiences that, supplementing the core record, will throw light on the nature and the extent of any fracturing or abnormalities.

#### 3.7.2 Arrangement of Core

Provide core boxes in compliance with PART 2, paragraph CORE BOXES. Arrange all cores neatly in the partitioned boxes in the same sequence in which they occurred before removal from the hole. Facing the open box with the hinged cover above and the open box below, arrange cores in descending sequence beginning at the left end of the trough nearest the hinges and continuing in the other troughs from left to right. Place the highest part of the core in box 1, and place the lower portions of the core in the other boxes in consecutive order.

#### 3.7.3 Preservation of Core

Wrap representative samples of core to the outside of the wrapping material prior to placing the core in the core box. Accomplish this sealing process as soon as possible after the core is removed from the core barrel. A minimum length of core that is preserved from each boring less than 2.5 times the core diameter is not acceptable. Mark and place spacer blocks in the core box to show where samples have been removed.

#### 3.7.4 Labeling, Marking and Packing Core

Place stenciled labels for core boxes complying with paragraph CORE BOX LABELS on the inside and outside of the top cover in addition to each end. In addition, mark the depths (or elevations) of each core run/pull with a

black waterproof pen on the spacer blocks that are placed between core pulls. When a box is full, fill the space between the core and the trough sides with finely ground vermiculite or other packing material approved by the Contracting Officer.

### 3.7.5 Disposition of Core

While onsite, protect the filled core boxes from direct sunlight, precipitation, and freezing by some form of Contracting Officer approved shelter that allows ventilation to the boxes. Upon completion of core drilling and sampling operations, [store core boxes containing cores in an area provided by the Contracting Officer near the site of drilling] [ship or deliver core boxes containing cores to [provide address]].

## 3.8 TEST PIT EXCAVATION AND SAMPLING

### 3.8.1 Excavation

Excavate the test pits in the order scheduled in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING, and excavate to depths and dimensions indicated in paragraph SCHEDULE OF DRILLING, SAMPLING, AND TESTING. Become thoroughly familiar with work site and with all available subsurface data, particularly groundwater conditions, before excavating pits. Regardless of the method of excavation employed, excavate, dewater and shore/line the pits in conformance with all applicable safety regulations.

### 3.8.2 Sampling

Obtain soil samples from each pit at depths determined by the Contracting Officer. Obtain samples from each test pit. In obtaining samples from test pits, preserve the undisturbed in situ (in place) natural physical and structural characteristics of the sampled materials insofar as possible both while samples are being taken and during shipment to the point of testing. In cohesive and partially cohesive soils this may be accomplished by isolating the soil column or cube to be sampled by gently trenching around it and knife-trimming it to the required dimensions of the split cylinder or box. Apply a thin coating of melted wax quickly but gently to the sample with a paint brush to seal it against loss of moisture. Remove the top and bottom from the metal or wooden sample container and place over the wax coated sample such that the sample is centered within the container and the top of the container sides are at least 1 inch above the top of the sample. Fill the spaces between the sample and the side walls of the container with melted wax. After this wax has congealed, fill the space between the top of the sample container sides and the top of the sample with wax. After this wax has congealed, trim so that when the top of the sample container is installed there is no void between the container top and the wax. After the container top is installed, cut off the soil column or cube few inches below the container, invert and remove the sample and container from the pit and trim the sample at the base so that the bottom of the sample is at least 1 inch below the bottom of the container. Fill this space with wax and, after the wax has congealed, trim it so that when the bottom of the container is installed, there is no void between the wax and the bottom of the container. Where overburden materials to be sampled are only partially cohesive, it is best not to expose the entire soil column before waxing. By exposing and waxing small sections at a time, the sample will be subjected to less disturbance. Where natural moisture content is an important factor, do not delay taking the sample in order to retain the natural moisture content of the material to the fullest extent.

### 3.8.3 Disposition of Samples

Pack samples in vermiculite or a packing material approved by the Contracting Officer and ship in sturdy wooden boxes of strength and construction sufficient to guarantee against damage during shipment. Boxes should be no larger than is required for shipping two such samples. Mark all sample boxes FRAGILE-HANDLE WITH CARE and identify by labels, similar to those as specified in paragraph IDENTIFYING SAMPLES, attached to the outside of each box. Take extreme care to indicate the top and bottom of each sample. Avoid exposing sealed and crated samples to precipitation and extremes of temperature. Replace frozen, as well as partially frozen, undisturbed samples. Do not hold these samples at the site for a period in excess of one week. Prior to shipment, check each sealed and boxed sample for correct labeling.

### 3.9 SUPPLEMENTAL [BORINGS] [PITS]

Borings that are abandoned or from which unsatisfactory samples or cores are obtained will be supplemented by other [borings] adjacent to the original in order that satisfactory samples or the required information will be obtained. Actual locations of any supplemental borings will be established by the Contracting Officer. Penetration to the depth where the original was abandoned or to the depths where unsatisfactory samples were obtained may be made by any method selected by the Contractor that in the opinion of the Contracting Officer will permit satisfactory completion and sampling below the elevation where the last satisfactory sample was obtained in the abandoned or satisfactory sampling in the reaches where satisfactory samples were not obtained in the original borings. No payment will be made for supplemental borings that are required to be drilled to replace borings that were abandoned or from which satisfactory samples were not obtained because of mechanical failure of drilling and sampling equipment, negligence on the part of the Contractor, or other preventable cause for which the Contractor is responsible except that payment will be made for acceptable portions of these supplementary borings below the depths or outside the reaches for which payment was made for the original borings.

### 3.10 BACKFILLING

#### 3.10.1 Drill Holes

Unless otherwise noted in these specifications or directed by the Contracting Officer, backfill and abandon all drill holes in accordance with all Federal, State, and local laws, regulations and ordinances. Preserve all holes in good condition until final measurement and until the records and samples have been accepted. Perform all backfilling operations in the presence of the Contracting Officer and, if required by regulation, Federal, State, and local officials. No separate payment will be made for backfilling drill holes. Include the cost of this work in the drilling costs.

#### 3.10.2 Test Pits

Backfill all test pits with local soil compacted to original densities as directed by the Contracting Officer. No separate payment will be made for backfilling test pits. Include the cost of this work in the test pit excavation costs.

### 3.11 RECORDS

Submit complete, legible copies of DRILLING LOG, ENG FORM 1836 and 1836A, and records to the Contracting Officer upon completion of the work or at such other time or times as directed. Keep accurate driller's logs (DRILLING LOG, ENG FORM 1836, and 1836-A will be provided by the Contracting Officer) and records of all work accomplished under this contract and deliver complete, legible copies of these logs and records to the Contracting Officer upon completion of the work or at such other time or times as directed]. Record all such records during the actual performance of the work and preserve in good condition and order until they are delivered and accepted. The Contracting Officer has the right to examine and review all such records at any time prior to their delivery and has the right to request changes to the record keeping procedure. Include the following information on the logs or in the records for each hole:

- a. Hole number or designation and elevation of top of hole .
- b. Driller's name and Geologist's name.
- c. Make, size, and manufacturer's model designation of drilling, sampling, ] equipment.
- d. Type of drilling, sampling, operation by depth.
- e. Hole diameter.
- f. Dates and time by depths when drilling, sampling, operations were performed.
- g. Time required for .
- h. Drill action, rotation speed, hydraulic pressure, water pressure, tool drops, and any other unusual and non-ordinary experience which could indicate the subsurface conditions encountered.
- i. Depths at which samples or cores were recovered or attempts made to sample or core including top and bottom depth of each run.
- j. Classification or description by depths of the materials sampled, cored, or penetrated using the Unified Soil Classification System (ASTM D2487 ) and including a description of moisture conditions, consistency and other appropriate descriptive information described in paragraph SUPPLEMENTAL BORINGS of ASTM D2488. Make this classification or description immediately after the samples or cores are retrieved.
- k. Percentage of sample or core recovered per run.
- l. Depth at which groundwater is encountered initially and when stabilized.
- m. Depths at which drill water is lost and regained and amounts.
- n. Depths at which the color of the drill water return changes.
- o. Type and weight of drill fluid.
- p. Depth of bottom of hole.
- q. Pressures employed in pressure testing.



TABLE 1 - COMMON CORE DIAMETERS		
	CORE DIAMETER INCHES	HOLE DIAMETER INCHES
Conventional Core Barrels		
AWG	1.185	1.890
BWG	1.655	2.360
NWG	2.155	2.980
HWG	3.000	3.907
Wireline Core Barrels*		
A	1.064	1.890
B	1.432	2.360
N	1.875	2.980
H	2.450	3.716
	3.345	4.827
Large Diameter Series		
2-3/4" X 3-7/8"	2.690	3.875
4" X 5-1/2"	3.970	5.495
6" X 7-3/4"	5.970	7.750
* No Industry Standard for Wireline Sizes. Diameters shown for wireline core barrels are nominal and vary between manufacturers.		

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## SECTION 02 41 00

## DEMOLITION

08/22

## PART 1 GENERAL+

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K (2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145 (1991; R 2012) Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

AASHTO T 180 (2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6 (2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

## CARPET AND RUG INSTITUTE (CRI)

CRI 104 (2015) Carpet Installation Standard for Commercial Carpet

CRI 105 (2015) Carpet Installation Standard for Residential Carpet

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual

## U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (Jun 2000; Reaffirmed Oct 2010) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders;  
<https://www.dla.mil/Portals/104/Documents/DispositionSer>

/ddsr/docs/cylinderjointpub.pdf

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M	(2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures
MIL-STD-129	(2014; Rev R; Change 1 2018; Change 2 2019) Military Marking for Shipment and Storage

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 173.301	Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 PROJECT DESCRIPTION

1.2.1 Definitions

1.2.1.1 Demolition

Demolition is the process of tearing apart and removing any feature of a facility together with any related handling and disposal operations.

1.2.1.2 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

1.2.2 Demolition Plan

Prepare a [Demolition Plan](#) and submit proposed demolition and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work. Provide procedures for safe conduct of the work in accordance with [EM 385-1-1](#). Plan must be approved by Contracting Officer prior to work beginning.

1.2.3 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. The work includes demolition of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

### 1.3 ITEMS TO REMAIN IN PLACE

Comply with FAR 52.236-9 to protect existing vegetation, structures, equipment, utilities, and improvements. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload or any pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

#### 1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

#### 1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

#### 1.3.3 Trees

Protect trees within the project site which might be damaged during demolition, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

#### 1.3.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off, disconnected and sealed by the Contractor .

#### 1.3.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

#### 1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

#### 1.5 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available at contract award.

#### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

Demolition Plan; G

Existing Conditions

##### SD-07 Certificates

Notification; G

Notification of Demolition and Renovation Form

##### SD-11 Closeout Submittals

Receipts

#### 1.7 QUALITY ASSURANCE

Submit timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives be permitted.

##### 1.7.1 Dust and Debris Control

Prevent the spread of dust and debris to occupied portions of the building or on airfield pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

## 1.8 PROTECTION

### 1.8.1 Traffic Control Signs

a. Where pedestrian, driver and/or aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

b. Provide a minimum of 2 FAA type L-810 steady burning red obstruction lights on temporary structures (including cranes) over 100 feet, but less than 200 ft, above ground level. The use of LED based obstruction lights are not permitted. For temporary structures (including cranes) over 200 ft above ground level provide obstruction lighting in accordance with FAA AC 70/7460-1. Perform light construction and installation in compliance with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer. Maintain the temporary services during the period of construction and remove only after permanent services have been installed and tested and are in operation.

### 1.8.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

## 1.9 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. Provide a barricade consisting of a fence covered with a fabric designed to stop the spread of debris. Anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

## 1.10 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.11 EXISTING CONDITIONS

Before beginning any demolition, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs or electronic images with a minimum resolution of 3072 x 2304 pixels, capable of a print resolution of 300 dpi, will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results to the Contracting Officer.

PART 2 PRODUCTS

2.1 FILL MATERIAL

- a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.
- b. Provide fill material conforming to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material must be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.
- c. Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180, Method B or D

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Disassemble existing construction scheduled to be removed for reuse. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Designate materials for reuse onsite whenever possible.

3.1.1 Structures

- a. Remove existing structures indicated to be removed to . Remove interior walls, other than retaining walls and partitions, shall be removed to top of concrete slab on ground. Break up basement slabs to permit drainage. Remove sidewalks, curbs, gutters and street light bases as indicated.



- b. Demolish structures in a systematic manner from the top of the structure to the ground. Complete demolition work above each tier or floor before the supporting members on the lower level are disturbed. Demolish concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means of derricks, platforms hoists, or other suitable methods as approved by the Contracting Officer.
- c. Locate demolition and deconstruction equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.
- d. Building, or the remaining portions thereof, not exceeding 80 feet in height may be demolished by the mechanical method of demolition if approved by the Contracting Officer.

### 3.1.2 Utilities and Related Equipment

#### 3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

#### 3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

#### 3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 25 foot lengths and store in rolls off the ground.

#### 3.1.4 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated to a depth of 4 inches below existing adjacent new finish grade. Demolition of concrete pavement on airfields and other heavy duty pavements will follow methods in Section 32 13 14.13 CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS. Provide neat sawcuts at limits of pavement removal as indicated. Move, grind and store pavement and slabs designated to be recycled and utilized in this project as directed by the Contracting Officer. Remove pavement and slabs not to be used in this project from the installation at Contractor's expense.

#### 3.1.5 Roofing

Remove existing roof system and associated components in their entirety

down to existing roof deck. Remove built-up roofing to effect the connections with new flashing or roofing. Remove gravel surfacing from existing roofing felts for a minimum distance of 18 inches back from the cut. Remove gravel without damaging felts. Cut existing felts membrane and insulation along straight lines. Remove roofing system and insulation without damaging the roof deck. Sequence work to minimize building exposure between demolition or deconstruction and new roof materials installation.

#### 3.1.5.1 Temporary Roofing

Install temporary roofing and flashing as necessary to maintain a watertight condition throughout the course of the work. Remove temporary work prior to installation of permanent roof system materials unless approved otherwise by the Contracting Officer. If the existing deck and support structure is deteriorated, such that ability to support foot traffic and construction loads is unknown. Make provisions for worker safety during demolition, and installation of new materials as described in paragraphs entitled "Statements" and "Regulatory and Safety Requirements."

#### 3.1.5.2 Reroofing

When removing the existing roofing system from the roof deck, remove only as much roofing as can be recovered by the end of the work day, unless approved otherwise by the Contracting Officer. Do not attempt to open the roof covering system in threatening weather. Reseal all openings prior to suspension of work the same day.

#### 3.1.6 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new work. Where new masonry adjoins existing, abut or tie the new work into the existing construction as indicated. Provide square, straight edges and corners where existing masonry adjoins new work and other locations.

#### 3.1.7 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Sawcuts in existing concrete sidewalk must be at the nearest existing expansion joint or weakened plane joint and at full depth.

#### 3.1.8 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage. Salvage for recycle structural steel, steel joists, girders, angles, plates, columns and shapes. Flame-cutting torches are permitted when other methods of dismantling are not practical. Transport steel joists and girders as whole units and not dismantled. Transport structural steel shapes to a designated recycling facility area as directed by the Contracting Officer, stacked according to size, type of member and length, and stored off the ground, protected from the weather.

#### 3.1.9 Miscellaneous Metal

Salvage shop-fabricated items such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railings, metal windows and similar items as whole units. Salvage light-gage and cold-formed metal framing, such as steel studs, steel trusses, metal gutters, roofing and siding, metal toilet partitions, toilet accessories and similar items. Scrap metal is the Contractor's property. Recycle scrap metal as part of demolition operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

#### 3.1.10 Carpentry

Salvage for recycle lumber, millwork items, and finished boards, and sort by type and size. Chip or shred and recycle salvaged wood unfit for reuse, except stained, painted, or treated wood. Remove windows, doors, frames, and cabinets, and similar items as whole units, complete with trim and accessories. Do not remove hardware attached to units, except for door closers. Brace the open end of door frames to prevent damage.

#### 3.1.11 Carpet

Remove existing carpet for reclamation in accordance with manufacturer recommendations and as follows. Remove used carpet in large pieces, roll tightly, and pack neatly in a container. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI). Provide adhesive removal solvents in compliance with [CRI 104](#)/[CRI 105](#).

#### 3.1.12 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, give priority to a local recycling organization. Recycling is not required if the tiles contain or may have been exposed to asbestos material.

#### 3.1.13 Airfield Lighting

Remove existing airfield lighting as indicated and terminate in a manner satisfactory to the Contracting Officer. Remove edge lights, associated transformers as indicated and deliver to a location on the station in accordance with instructions of the Contracting Officer [or](#) dispose of off station.

#### 3.1.14 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Make finished surfaces of patched area flush with the adjacent existing surface and match the existing adjacent surface as closely as possible to texture and finish. Provide patching as specified and indicated, and include the following:

- a. Concrete and Masonry: Completely fill holes and depressions, left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

- b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.
- c. Patch acoustic lay-in ceiling where partitions have been removed. Make the transition between the different ceiling heights by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

#### 3.1.15 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

#### 3.1.16 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

#### 3.1.17 Locksets on Swinging Doors

Remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Contracting Officer after removal.

#### 3.1.18 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated storage area as directed by the Contracting Officer. Do not remove equipment until approved. Do not offer low-efficiency equipment for reuse; provide to recycling service for disassembly and recycling of parts.

##### 3.1.18.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; drain tanks, piping and fixtures; if previously used to store flammable, explosive, or other dangerous liquids, steam clean interiors. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

##### 3.1.18.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, attach end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed

valve to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for salvage, or not reusable, as scrap metal.

#### 3.1.18.3 Ducts

Classify removed duct work as scrap metal.

#### 3.1.18.4 Fixtures, Motors and Machines

Remove and salvage fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations. Salvage, box and store auxiliary units and accessories with the main motor and machines. Tag salvaged items for identification, storage, and protection from damage. Classify non-porcelain broken, damaged, or otherwise unserviceable units and not caused to be broken, damaged, or otherwise unserviceable as debris to be disposed of by the Contractor.

#### 3.1.19 Electrical Equipment and Fixtures

Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

##### 3.1.19.1 Fixtures

Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent, mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1978, boxed and tagged for identification, and protected from breakage.

##### 3.1.19.2 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

##### 3.1.19.3 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

##### 3.1.19.4 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and

disposed.

### 3.1.20 Elevators and Hoists

Remove elevators, hoists, and similar conveying equipment and salvage as whole units, to the most practical extent. Remove and prepare items for salvage without damage to any of the various parts. Salvage and store rails for structural steel with the equipment as an integral part of the unit.

### 3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

### 3.3 DISPOSITION OF MATERIAL

#### 3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, become the property of the Contractor and must be removed from Government property. Materials approved for storage by the Contracting Officer must be removed before completion of the contract. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

#### 3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed in the Demolition Plan indicated to be reused or relocated to prevent damage, and reinstall as the work progresses. Coordinate the re-use of materials and equipment with the re-use requirements in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Capture re-use of materials in the diversion calculations for the project.

#### 3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are listed in the Demolition Plan indicated and specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed by the Contracting Officer.

- a. Salvage items and material to the maximum extent possible.
- b. Store all materials salvaged for the Contractor as approved by the Contracting Officer and remove from Government property before completion of the contract. Coordinate the salvaged materials with tracking requirements in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Capture salvaged materials in the diversion calculations for the project.
- c. Remove salvaged items to remain the property of the Government in a

manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers. Deliver the following items reserved as property of the Government to the areas designated by the Contracting Officer.

- d. Remove the following items reserved as property of the using service prior to commencement of work under this contract.
- e. Remove historical items in a manner to prevent damage. Deliver the following historical items to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.
- f. Remove and capture all Class I ODS refrigerants in accordance with the Clean Air Act Amendment of 1990, and turn in to the Navy as directed by the Commanding Officer. by shipping the refrigerant container to the Defense Logistics Agency at the following address:

Defense Depot Richmond VA (DDRV)  
SW0400  
Cylinder Operations  
8000 Jefferson Davis Highway  
Richmond, VA 23297-5900

The Government will remove and capture Class I ODS refrigerants.

#### 3.3.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Remove recovered ODS from Government property and dispose of in accordance with 40 CFR 82. Dispose products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

##### 3.3.4.1 Special Instructions

No more than one type of ODS is permitted in each container. Apply a warning/hazardous label to the containers in accordance with Department of Transportation regulations. Provide a tag with the following information on all cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment
- e. National stock number (for information, call (804) 279-4525).

### 3.3.4.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

### 3.3.5 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

### 3.3.6 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable combustible material off of Moody Air Force Base. Storage of removed materials on the project site is prohibited.

## 3.4 CLEANUP

Remove debris and rubbish from project site and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

## 3.5 DISPOSAL OF REMOVED MATERIALS

### 3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

### 3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Moody Air Force Base.

### 3.5.3 Removal from Government Property

Transport waste materials removed from demolished structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

## 3.6 REUSE OF SALVAGED ITEMS

If approved for reuse by the Contracting Officer, recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --



## SECTION 02 42 51

## CARPET REMOVAL AND RECLAMATION

11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

**ASSP A10.6** (2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

**EPA 340/1-90/018** (1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance

**EPA AP-42** (1995) Compilation of Air Pollution Emission Factors

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**40 CFR 61-SUBPART M** National Emission Standard for Asbestos

**40 CFR 247** Comprehensive Procurement Guideline for Products Containing Recovered Materials

## 1.2 SUMMARY

Furnish a contract for used carpet reclamation, including planned procedures for removal and reclamation of used carpet.

Refer to related Section **09 68 00 CARPETING** for floor preparation prior to installation of new carpet.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section **01 33 00 SUBMITTAL PROCEDURES**:

**SD-01 Preconstruction Submittals**

Dust-Control Measures; G

Packing and Transportation Measures; G

Schedule of Carpet Reclamation Activities; G

## Carpet Reclamation Agency Records; G

## 1.4 QUALITY CONTROL

## 1.4.1 Carpet Reclamation Agency

Provide documentation of being a Carpet America Recovery Efforts (CARE) approved carpet removal contractor (or designated agent firm) providing used carpet recycling under the most current EPA recognized Carpet Reclamation Program, or equivalent from alternate recycling agent.

## 1.4.2 Carpet Remover Requirements

Submit details for the following:

dust-control measures

packing and transportation measures

## 1.4.3 Carpet Reclamation Agency Submittal

Submit a copy of [carpet reclamation agency records](#) verifying receipt and disposition of used carpet.

## 1.4.4 Regulatory Requirements

Comply with governing regulations; including, but not limited to:

- a. [EPA 340/1-90/018](#)
- b. [EPA AP-42](#)
- c. [40 CFR 61-SUBPART M](#)
- d. [ASSP A10.6](#)
- e. [40 CFR 247](#)

Comply with hauling and disposal regulations of authorities having jurisdiction. Record and maintain records of all off-site removal of debris and materials.

Provide the following information regarding the removed materials within the [schedule of carpet reclamation activities](#):

- a. Time and Date of Removal.
- b. Type of Material.
- c. Weight and Quantity of Materials.
- d. Final Destination of Materials.

## 1.4.4.1 Carpet Reclamation Agency and Carpet Remover Certification

Certify in writing that used carpet was removed and recycled in accordance with the current EPA recognized Carpet Reclamation Program. Do not place removed carpet and associated materials in a landfill.

## 1.5 PROJECT/SITE CONDITIONS

### 1.5.1 Environmental Requirements

Obtain approval of Owner before performing operations which generate contaminants.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Carpet Reclamation Agency

The current approved reclamation agency is Carpet America Recovery Effort (CARE).

#### 2.1.2 Carpet Removers

Submit documentation of being a CARE approved carpet removal contractor.

### 2.2 MATERIALS

#### 2.2.1 Adhesive Removal Solvents

Comply with Carpet and Rug Institute Publication 104.

#### 2.2.2 Used Carpet

Maintain possession of removed used carpet. Immediately remove from site and place in container or trailer.

Carefully remove, store, and protect designated materials and equipment for re-installation under other Sections or for retention by Owner.

#### 2.2.3 Carpet Pad

Provide recycling of carpet padding where locally available or as designated by Carpet Reclamation Agency.

## PART 3 EXECUTION

### 3.1 EXAMINATION

#### 3.1.1 Verification of Conditions

Examine areas and conditions under which work is to be performed. Identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

Provide, erect, and maintain barricades, lighting, and guardrails as required to protect general public, workers, and adjoining property.

Vacuum used carpet before removal.

### 3.3 APPLICATION

#### 3.3.1 Carpet Removal

Remove used carpets in large pieces, roll tightly, and pack neatly in container. Include carpet scrap and waste from new installation.

Deposit only clean, dry carpet in containers. "Clean" is defined as free from demolition debris, asbestos contamination, garbage, and tack strips.

Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI).

### 3.3.2 Container Disposal

Place used carpet in fully-enclosed, front [end] loading **40-yard container** supplied by Carpet Reclamation Agency. Place only used commercial carpeting in collection container. Keep container locked or supervised.

Use effective packing techniques to maximize the amount of material in the container. On average, a container holds **2,000-3,000 square yards**. Neatly stack carpet tiles or repack in cardboard boxes before placing in container.

When container is full, contact Carpet Reclamation Agency to coordinate pickup and drop-off of replacement container. If container is locked for security purposes, remove lock before pickup.

### 3.3.3 Truck Trailer Disposal

Place used carpet in a **53 foot** trailer supplied by Carpet Reclamation Agency. Place only used commercial carpeting in trailer. Keep trailer locked or supervised.

Use effective packing techniques to maximize the amount of material in the trailer. Comply with Department of Transportation regulations for weight limits. Typical maximum weight of used carpet on trailers is **45,000 pounds**.

Neatly stack carpet tiles or repack in cardboard boxes before placing in trailer. Do not stack higher than **6 feet**. When trailer is full, contact Carpet Reclamation Agency to coordinate pickup and drop-off of replacement trailer. If trailer is locked for security purposes, remove lock before pickup.

### 3.3.4 Interior Operations

Seal doors and other openings with duct tape at heads, jambs, and sills to contain contaminants from work which occurs within a single room.

Use window exhaust systems to establish negative pressure in contaminant-producing work areas, ensuring continuous flow of air into work area.

Do not open windows in work area except when an exhaust fan is used. Close windows at end of each work shift. Seal exhaust system ductwork which might leak into building or mechanical systems.

Damp mop hard surface floors in work area daily to minimize tracking of contaminants from work area. In carpeted areas, protect carpet with plastic and plywood. Provide hard-surfaced area at entrances for daily damp mopping.

-- End of Section --



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## SECTION 02 61 13

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL  
02/10, CHG 1: 02/21

## PART 1 GENERAL

## 1.1 MEASUREMENT AND PAYMENT

## 1.1.1 Measurement

Base measurement for excavation and onsite transportation on the actual number of cubic yards of contaminated material in-place prior to excavation. Base determination of the volume of contaminated material excavated on cross-sectional volume determination reflecting the differential between the original elevations of the top of the contaminated material and the final elevations after removal of the contaminated material. Base measurement for backfilling of excavated areas on in-place cubic yards of compacted fill. Base measurement for construction of stockpile areas on the number of square yards of stockpile liner constructed.

## 1.1.2 Payment

## 1.1.2.1 Excavation and Transportation

Compensation for excavation and onsite transportation of contaminated material will be paid as a unit cost. Include any other items incidental to excavation and handling not defined as having a specific unit cost.

## 1.1.2.2 Backfilling

Compensation for backfill soil, transportation of backfill, backfill soil conditioning, backfilling, compaction, and geotechnical testing will be paid as a single unit cost.

## 1.1.2.3 Stockpiling

Compensation for construction of stockpile areas will be paid for as a unit cost. Include all aspects of grading, preparation, handling, placement, maintenance, removal, treatment, and disposal of stockpile cover materials and liner materials and all other items incidental to construction of stockpiles in the unit cost.

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM D698

(2012; E 2014; E 2015) Laboratory  
Compaction Characteristics of Soil Using  
Standard Effort (12,400 ft-lbf/cu. ft.  
(600 kN-m/cu. m.))

ASTM D1556/D1556M

(2015; E 2016) Standard Test Method for

Density and Unit Weight of Soil in Place  
by Sand-Cone Method

- ASTM D1557 (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2700 kN-m/m<sup>3</sup>)
- ASTM D2167 (2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- ASTM D2487 (2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D5434 (2012) Field Logging of Subsurface Explorations of Soil and Rock
- ASTM D6938 (2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- ASTM D7928 (2017) Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

U.S. ARMY CORPS OF ENGINEERS (USACE)

- EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1926 Safety and Health Regulations for Construction
- 40 CFR 302 Designation, Reportable Quantities, and Notification

### 1.3 DESCRIPTION OF WORK

Approximate locations of contaminated material are shown on the drawings. Submit a [Work Plan](#) as specified below. Notify the Contracting Officer within 24 hours, and before excavation, if contaminated material is discovered that has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered. Backfill material is not available onsite. Conduct required sampling and chemical analysis in accordance with [\_\_\_\_\_].

#### 1.3.1 Scheduling

Notify the Contracting Officer 10 calendar days prior to the start of excavation of contaminated material. The Contractor is responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.



### 1.3.2 Work Plan

Submit a Work Plan within 30 calendar days after notice to proceed. Do not perform work at the site, with the except site inspections and surveys, until the Work Plan is approved. Allow 30] calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, include the following in the the Work Plan:

- a. Schedule of activities.
- b. Method of excavation and equipment to be used.
- c. Shoring or side-wall slopes proposed.
- d. Dewatering plan.
- e. Storage methods and locations for liquid and solid contaminated material.
- f. Borrow sources and haul routes.
- g. Decontamination procedures.
- h. Spill contingency plan.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Work Plan; G

#### SD-02 Shop Drawings

Surveys

#### SD-06 Test Reports

Compaction

Closure Report; G

### 1.5 REGULATORY REQUIREMENTS

#### 1.5.1 Permits and Licenses

Obtain required federal, state, and local permits for excavation and storage of contaminated material. Obtain permits at no additional cost to the Government.

#### 1.5.2 Air Emissions

Monitor and control air emissions in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

PART 2 PRODUCTS

2.1 SPILL RESPONSE MATERIALS

Provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Make spill response materials available at all times when contaminated materials/wastes are being handled or transported. Provide spill response materials that are compatible with the type of materials and contaminants being handled.

2.2 BACKFILL

Obtain backfill material from offsite sources approved by the Contracting Officer. Classify backfill in accordance with ASTM D2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH. Provide backfill that is free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Test backfill material for the parameters listed below at a frequency of once per 3000 cubic yards. Perform a minimum of one set of classification tests per borrow source. Also collect and test two backfill sample per borrow source for the chemical parameters listed below.

Physical Parameter	Criteria	Test Method
Grain Size	[_____]	ASTM D7928
Compaction	[_____]	ASTM D698
[_____]	[_____]	[_____]

Chemical Parameter	Test Frequency	Criteria
[_____]	[_____]	[_____]

Do not use material for backfill until borrow source chemical and physical test results have been submitted and approved.

PART 3 EXECUTION

3.1 SURVEYS

Perform surveys immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Also, perform surveys immediately after backfill of each excavation. Provide cross-sections on 25 foot intervals and at break points for all excavated areas. Survey and show locations of confirmation samples on the drawings. Perform surveys in accordance with Section: [\_\_\_\_\_].

3.2 EXISTING STRUCTURES AND UTILITIES

Do not perform excavation until site utilities have been field located. Take the necessary precautions to ensure no damage occurs to existing

structures and utilities. Repair damage to existing structures and utilities resulting from the Contractor's operations at no additional cost to the Government. Do not disturb utilities encountered that were not previously shown or otherwise located without approval from the Contracting Officer.

3.3 CLEARING

Perform clearing to the limits shown on the drawings in accordance with Section 31 11 00 CLEARING AND GRUBBING.

3.4 CONTAMINATED MATERIAL REMOVAL

3.4.1 Excavation

Excavate areas of contamination to the depth and extent shown on the drawings and not more than 0.2 ft beyond the depth and extent shown on the drawings unless directed by the Contracting Officer. Perform excavation in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. Maintain an excavation log describing visible signs of contamination encountered for each area of excavation. Prepare excavation logs in accordance with ASTM D5434.

3.4.2 Shoring

If workers must enter the excavation, evaluate, shore, slope or brace it as required by EM 385-1-1 and 29 CFR 1926 section 650.

3.4.3 Dewatering

Divert surface water to prevent entry into the excavation. Limit dewatering to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met. Do not perform dewatering without prior approval of the Contracting Officer.

3.5 CONFIRMATION SAMPLING AND ANALYSIS

The Contracting Officer will be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, examine the excavation for evidence of contamination. If the excavation appears to be free of contamination, use field analysis to determine the presence of contamination using a real time vapor monitoring instrument immunoassay field kits as approved by the Contracting Officer. Excavate additional material as directed by the Contracting Officer. After all suspected contaminated material is removed, collect confirmation samples and analyze for the following contaminants:

Chemical Parameter	Action Level
[_____]	[_____]

Collect samples at a frequency of one sample from the bottom and each of the side walls or as directed by the Contracting Officer. Collect a minimum of one sample from the bottom and each side wall of the excavation. Based on test results, propose any additional excavation which may be required to remove material which is contaminated above action levels. Additional excavation is subject to approval by the Contracting Officer. Mark locations of samples in the field and document on the

as-built drawings.

3.6 CONTAMINATED MATERIAL STORAGE

Place material in temporary storage immediately after excavation. The following paragraphs describe acceptable methods of material storage. Provide storage units that are in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, clearly label each unit with an identification number and keep a written log to track the source of contaminated material in each temporary storage unit.

3.6.1 Stockpiles

Construct stockpiles to isolate stored contaminated material from the environment. Stockpile size greater than 200 cubic yards is prohibited. Construct stockpiles to include:

- a. 200.
- b. Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Provide non-reinforced geomembrane covers that have a minimum thickness of 10 mils. Provide scrim reinforced geomembrane covers that have a minimum weight of 26 lbs/1000 square feet. Extend the cover material over the berms and anchor or ballast to prevent it from being removed or damaged by wind.
- c. Berms surrounding the stockpile, a minimum of 12 inches in height. Berm vehicle access points.
- d. Slope the liner system to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

3.6.2 Roll-Off Units

Use water-tight roll-off units used to temporarily store contaminated material. Place a cover over the units to prevent precipitation from contacting the stored material. Locate the units as shown on the drawings. Remove liquid which collects inside the units and store in accordance with paragraph Liquid Storage.

3.6.3 Liquid Storage

Temporarily store liquid collected from excavations and stockpiles in 55 gallon barrels. Provide water-tight liquid storage containers and locate as indicated on the drawings.

3.7 SAMPLING

3.7.1 Sampling of Stored Material

Collect samples of stored material at a frequency of once per 50 cubic yards. Test samples for the following:

Chemical Parameter	Action Level
[_____]	[_____]

Treat stored material with contaminant levels that exceed the action levels offsite. Analyses for contaminated material to be taken to an offsite treatment facility must conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Furnish documentation of all analyses performed to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility is the responsibility of the Contractor and must be performed at no additional cost to the Government. onsite. Perform treatment in accordance with Section [\_\_\_\_\_].

3.7.2 Sampling Liquid

Sample liquid collected at a frequency of once for every 500 gal of liquid collected. Test samples for the following:

Chemical Parameter	Action Level
[_____]	[_____]

Treat liquid with contaminant levels that exceed action levels offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility must conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Furnish documentation of all analyses performed to the Contracting Officer. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material is the responsibility of the Contractor and must be performed at no additional cost to the Government. Perform treatment accordance with Section [\_\_\_\_\_].

3.7.3 Sampling Beneath Storage Units

Collect samples from beneath each storage unit prior to construction of and after removal of the storage unit. Collect samples at a frequency of one per each 20 square yards from a depth interval of 0 to 0.5feet and test for the following:

Chemical Parameter	Action Level
[_____]	[_____]

Based on test results, remove soil which has become contaminated above action levels at no additional cost to the Government. Handle contaminated material which is removed from beneath the storage unit in accordance with paragraph Sampling of Stored Material. As directed by the Contracting Officer and at no additional cost to the Government, perform additional sampling and testing to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

3.8 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, follow the pre-established procedures as described in the RCRA Contingency Plan Base Wide Contingency Plan for immediate reporting and containment. Take immediate containment actions to minimize the effect of any spill or leak. Perform cleanup in accordance with applicable federal, state, and local regulations. As directed by the Contracting Officer, perform additional

sampling and testing to verify spills have been cleaned up. Perform spill cleanup and testing at no additional cost to the Government.

### 3.9 BACKFILLING

#### 3.9.1 Confirmation Test Results

Backfill excavations immediately after all contaminated materials have been removed and confirmation test results have been approved. Place and compact backfill to the lines and grades shown on the drawings.

#### 3.9.2 Compaction

Place approved backfill in lifts with a maximum loose thickness of 8 inches. Compact soil to 90 percent of [ASTM D698] [ASTM D1557] maximum dry density. Perform density tests at a frequency of once per 10,000 square feet per lift. Conduct a minimum of one density test on each lift of backfill placed. Determine field in-place dry density in accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938. If ASTM D6938 is used, check a minimum of one in ten tests using ASTM D1556/D1556M or ASTM D2167. Test results from ASTM D1556/D1556M or ASTM D2167 will govern if there is a discrepancy with the ASTM D6938 test results.

### 3.10 DISPOSAL REQUIREMENTS

Perform offsite disposal of contaminated material in accordance with Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

### 3.11 CLOSURE REPORT

Submit 6 copies of a Closure Report within 14 calendar days of completing work at the site. Label the report with the contract number, project name, location, date, name of general Contractor, and the Corps of Engineers District contracting for the work. As a minimum, include the following information:

- a. A cover letter signed by a Professional Engineer registered in the State of Georgia who is a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.
- b. A narrative report including, but not limited to, the following:
  - (1) site conditions, ground water elevation, and cleanup criteria;
  - (2) excavation logs;
  - (3) field screening readings;
  - (4) quantity of materials removed from each area of contamination;
  - (5) quantity of water/product removed during dewatering;
  - (6) sampling locations and sampling methods;
  - (7) sample collection data such as time of collection and method of preservation;
  - (8) sample chain-of-custody forms; and

- (9) source of backfill.
- c. Copies of all chemical and physical test results.
- d. Copies of all manifests and land disposal restriction notifications.
- e. Copies of all certifications of final disposal signed by the responsible disposal facility official.
- f. Waste profile sheets.
- g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 50 feet of excavation, sample locations, and sample identification numbers. Show on-site stockpile, storage, treatment, loading, and disposal areas on the drawings.
- h. Progress Photographs. Use color photographs to document progress of the work. Take a minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions before work begins. After work has been started, photographically record daily activities at each work location. Provide photographs that are a minimum of 3 by 5 inches and include:
  - (1) Soil removal and sampling.
  - (2) Dewatering operations.
  - (3) Unanticipated events such as spills and the discovery of additional contaminated material.
  - (4) Contaminated material/water storage, handling, treatment, and transport.
  - (5) Site or task-specific employee respiratory and personal protection.
  - (6) Fill placement and grading.
  - (7) Post-construction photographs. After completion of work at each site, take a minimum of four views of each excavation site.

Include a digital version of all photos shown in the report with the Closure Report. Provide photographs that are a minimum of 3 inches by 5 inches and mount back-to-back in double face plastic sleeves punched to fit standard three ring binders. Attach an information box to each print. Arrange the typewritten box as follows:

Project Name:	Direction of View:
Location:	Date/Time:
Photograph No.:	Description of View:

-- End of Section --

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## SECTION 02 65 00

## UNDERGROUND STORAGE TANK REMOVAL

02/10, CHG 1: 11/13

## PART 1 GENERAL

## [1.1 UNIT PRICES

Assume, for bidding purposes, that soil bituminous pavement, concrete slabs, and water encountered during the removal of the underground tanks are contaminated with JP-5 fuel oil and diesel fuel and gasoline to be handled as specified herein. Wash bituminous pavement and concrete slabs and dispose of as demolition debris. Collect and store wash water.

## ]1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN PETROLEUM INSTITUTE (API)

- API PUBL 1628 (1996) A Guide to the Assessment and Remediation of Underground Petroleum Releases
- API RP 1604 (1996; R 2010) Closure of Underground Petroleum Storage Tanks
- API RP 2003 (2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
- API RP 2219 (2016) Safe Operation of Vacuum Trucks Handling Flammable and Combustible Liquids in Petroleum Service
- API STD 2217A (2017) Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries
- API Std 2015 (2018) Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks

## ASTM INTERNATIONAL (ASTM)

- ASTM D1556/D1556M (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
- ASTM D1557 (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2700 kN-m/m<sup>3</sup>)
- ASTM D2167 (2015) Density and Unit Weight of Soil in

Place by the Rubber Balloon Method

- ASTM D2487 (2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D4397 (2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
- ASTM D6938 (2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ARMY CORPS OF ENGINEERS (USACE)

- EM 200-1-1 (1994) Environmental Quality -- Validation of Analytical Chemistry Laboratories
- EM 200-1-6 (1997) Environmental Quality -- Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects
- EM 200-1-7 (2001) Environmental Quality - Performance Evaluation (PE) Program
- EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual
- EM 1110-1-4006 (1998) Engineering and Design -- Removal of Underground Storage Tanks (USTs)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

- EPA 530-R-97-007 (1997) Best Management Practices (BMPs) for Soils Treatment Technologies,, Suggested Operational Guidelines to Prevent Cross-Media Transfer of Contaminants During Cleanup Activities
- EPA 600/4-79/020 (1983) Methods for Chemical Analysis of Water and Wastes
- EPA SW-846 (Third Edition; Update IV) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1910 Occupational Safety and Health Standards
- 40 CFR 261 Identification and Listing of Hazardous Waste
- 40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

### 1.3 SYSTEM DESCRIPTION

The work consists of removal, decontamination and disposal of underground storage tank[s] and associated piping and ancillary equipment, including but not limited to dewatering (if approved), disposal of contaminated soil, laboratory testing, providing reports which are required by regulatory agencies, and backfilling.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Work Plan; G.  
 Site Safety and Health Plan; G  
 Excavation and Material Handling Plan; G  
 Field Sampling and Laboratory Testing Plan; G  
 Tank and Piping Removal And Disposal Plan; G  
 Spill and Discharge Control Plan; G  
 Qualifications; G  
 Laboratory Services; G  
 State Licensed Waste Transporter

#### SD-06 Test Reports

Laboratory and Field Testing Reports  
 Backfill Material  
 Tank Contents Verification  
 Contaminated Water Disposal  
 Soil Examination, Testing, and Analysis  
 Backfilling; G.

#### SD-11 Closeout Submittals

Salvage Rights; G

## Tank Closure Report

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Qualifications

Substantiate a minimum of 2 years of tank removal experience, including subcontractors and personnel employed on the project, and certification by the State for tank removal work. Experience must include removal, transportation, and disposal of underground tanks and associated piping, in conformance with the following:

- a. API RP 1604
- b. 40 CFR 280, State and local regulations and procedures.
- c. Applicable safety rules and regulations.
- d. Use of equipment and procedures for testing and vapor-freeing tanks.
- e. Handling and disposal of types of wastes encountered in underground tank and pipe removal including disposal of underground tanks and associated piping.
- f. Excavation, testing, and disposal of petroleum contaminated soils, liquids, and sludge.
- g. Project titles, dates performed, owner's names, points of contact for each project with current contact phone numbers.

#### 1.5.2 Laboratory Services

Submit documentation for laboratory services in accordance with EM 1110-1-4006, EM 200-1-1, EM 200-1-6 and EM 200-1-7.

#### 1.5.3 Support Staff

Identify all staff involved for the various components, including personnel collecting and shipping samples, and detail staff member's qualifications.

#### 1.5.4 Preconstruction Conference and Work Plan

Prior to the commencement of work, a preconstruction conference will be scheduled by the Contracting Officer. Prepare and submit a comprehensive Work Plan within 30 days of contract award. Provide work plan conforming to the requirements of this specification, API RP 1604, API Std 2015, API RP 2003, API STD 2217A and API RP 2219. Allow 30 days in the schedule for the Government's review and approval. No adjustment for time or money will be made for re-submittals required as a result of noncompliance. No work at the site is allowed, with the exception of site inspections and mobilization, until the Work Plan is approved. As a minimum, include the following in the Work Plan:

##### 1.5.4.1 Site Safety and Health Plan

Furnish detailed safety, health, and accident prevention provisions and develop a Site Safety and Health Plan (SSHP). Incorporate the requirements of 29 CFR 1910 and EM 385-1-1 into the SSHP. Include current training certification statement for personnel prior to entry into the work site.

Do not commence work until the SSHP is approved by the Contracting Officer. As a minimum, include the following:

- a. Health and safety organization, including discussion of distribution of functions and responsibilities.
- b. Organization and components of the SSHP.
- c. Physical and chemical site hazard identification.
- d. Basic toxicology and toxicity information.
- e. Discussion of the EZ and CRZ.
- f. Protective clothing.
- g. Respiratory protection.
- h. Air quality monitoring.
- i. Personnel exposure guidelines.
- j. Decontamination procedures.
- k. Basic first aid review.
- l. Emergency response and contingency plan.
- m. Site entry and exit procedures.
- n. Sampling procedures.

#### 1.5.4.2 Excavation and Material Handling Plan

Describe methods, means, equipment, sequence of operations and schedule to be employed in excavation, transport, handling, borrowing source and stockpiling of soil during underground tank removal. Include shoring requirements. Fifteen days before beginning tank removal work, submit to the Contracting Officer, for approval, a material handling plan that describes phases of dealing with the contaminated soil and water as it relates to the proposed tank[s] and piping removal, including methods of excavating, a material handling plan for the contaminated material, soil testing requirements, and water pumping and collection requirements.

#### 1.5.4.3 Field Sampling and Laboratory Testing Plan

Describe field sampling methods and quality control procedures. Identify laboratory and laboratory methods to be used for contamination testing. Include sample reports showing sample identification for location, date, time, sample method, contamination level, name of individual sampler, identification of laboratory, and quality control procedures.

#### 1.5.4.4 Tank and Piping Removal and Disposal Plan

Describe methods, means, sequence of operations, and schedule to be employed in the testing, pumping, cleaning, de-vaporizing, inspecting, [cutting and ]removal, and disposal of underground storage tanks and piping. Include methods to be employed for product, sludge, vapor, and

pumpable liquid removal; purging and inerting; and storage methods proposed for control of surface water. Also address the following:

- a. Treatment Options
- b. Identification of waste, tank and contaminated soil transporters and means of transport.
- c. Disposal and alternate facilities, disposal or remediation.
- d. Decontamination procedures and coordination with SSHP.

Coordinate decontamination procedures, shoring, and safety measures in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

#### 1.5.4.5 Spill and Discharge Control Plan

Develop a comprehensive spill and discharge control plan. Consider and provide contingency measures for potential spills and discharges from handling and transportation of contaminated soils and water. A possible source of guidance for assessment and remediation is API PUBL 1628.

#### 1.5.4.6 Site Safety And Health Officer

Identify an individual to serve as the Site Safety and Health Officer (SSHO) to report problems and concerns regarding health and safety to the Contracting Officer. Provide documentation that the SSHO possesses working knowledge of local and Federal occupational safety and health regulations, and provide training, in accordance with 29 CFR 1910 to Contractor employees in air monitoring practices and techniques. The SSHO must remain onsite to provide day to day industrial hygiene support, including air monitoring, training, and daily site safety inspections. The SSHO may be assigned other duties, such as project foreman or quality control manager.

#### 1.5.5 Permits and Licenses

As required or as directed by the Contracting Officer, obtain local, state, or federal permits and licenses that directly impact the Contractor's ability to perform the work prior to commencing removal operations.

#### 1.5.6 Statutes and Regulations

Perform tank closures, removal, and disposal in accordance with 40 CFR 280, 40 CFR 262, 40 CFR 264, and 40 CFR 265 as well as the applicable local, State of Georgia, and Federal regulations. Transport hazardous waste in accordance with Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

### 1.6 PROJECT/SITE CONDITIONS

Notify the Installation Environmental Coordinator (IEC) and the Contracting Officer 14 days prior to tank removal. The Contractor is responsible for contacting the Implementation Agency (IA) in accordance with the applicable reporting requirements.

## PART 2 PRODUCTS

### 2.1 BACKFILL MATERIAL

Obtain backfill material from [the location indicated] [offsite]. Classify backfill in accordance with ASTM D2487 as GW, GP, GM, GC, SW, SP, SM, SC,

MH, CL, or CH and free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Secure and submit soil classification test results, including the chain-of-custody records, prior to bringing offsite materials onsite. The testing frequency for backfill material is 1 per 1000 cubic yards or a minimum of 1 test. Use non-contaminated material removed from the excavation for backfill in accordance with Paragraph BACKFILLING.

## 2.2 PLASTIC SHEETING

Provide plastic sheeting conforming to ASTM D4397.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

Furnish labor, materials, necessary permits, laboratory tests, and reports and equipment to excavate, remove underground tanks and associated piping, and backfill to the level of the adjacent ground; sample soil and water to determine if contaminated; dispose of tanks and associated piping, and petroleum contaminated soil and water.

#### 3.1.1 Safety Guidelines

Comply with personnel safety guidelines specified in Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES, and conform to the guidelines as stipulated in the approved SSHP.

#### 3.1.2 Exclusion Zone (EZ) And Contamination Reduction Zone (CRZ)

Do not permit personnel, not directly involved with the project, to enter work zones, called the EZ and CRZ. The EZ is an area around the tank a minimum of 10 feet from the limits of the tank excavation. At the perimeter of the EZ, establish a CRZ. Clean equipment and personnel within the CRZ, as stated in the paragraph titled "Personnel and Equipment Decontamination." Locate the Contractor's site office, parking area, and other support facilities outside the EZ and CRZ. Clearly mark and post boundaries of the EZ and CRZ. Include a site map, outlining the extent of work zones and location of support facilities, in the SSHP.

#### 3.1.3 Onsite Training

Prior to starting onsite work, conduct a health and safety training class directed by the SSHO to discuss the implementation of the SSHP. Notify the Contracting Officer 24 hours prior to beginning the training class.

#### 3.1.4 Personnel Protection

Furnish appropriate personal safety equipment and protective clothing to personnel and ensure that safety equipment and protective clothing is kept clean and well maintained. Furnish three clean sets of personal protective equipment and clothing for use by the Contracting Officer or official visitors as required for entry into the EZ.

#### 3.1.5 Respiratory Protection Program

Fully employ respiratory protection program, addressing respirator usage and training, in accordance with 29 CFR 1910 and EM 385-1-1.

### 3.1.6 Decontamination

Decontaminate or properly dispose of personal protective equipment and clothing worn in contaminated areas at the end of the work day. The is responsible for ensuring that personal protective clothing and equipment are decontaminated before being reissued.

### 3.1.7 Emergency Response and First Aid Equipment

- a. Prior to commencement of work, thoroughly review emergency response and contingency plan in accordance with 29 CFR 1910. In an emergency, take action to remove or minimize the cause of the emergency, alert the Contracting Officer, and institute necessary measures to prevent repetition of the emergency. Equip site-support vehicles with route maps providing directions to the medical treatment facility.
- b. Provide appropriate emergency first aid equipment for treatment of exposure to site physical and chemical hazards. Provide and post a list of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other necessary contacts. Provide and post a route map detailing the directions to the nearest medical facility.
- c. Notify the Contracting Officer of any unforeseen hazard or condition which becomes evident during work.

### 3.1.8 Burning and Explosives

Use of explosives or burning debris is not allowed. Do not permit ignition sources in the EZ and CRZ.

### 3.1.9 Protection of Existing Structures and Utilities

Take all necessary precautions to avoid damage to existing structures, their appurtenances, monitoring wells, or utilities that may be affected by work activities. Repair any damage to utilities and monitoring wells resulting from the Contractor's operations at no expense to the Government. Coordinate with the installation to locate underground utilities prior to beginning construction. Do not disturb utilities encountered which were not previously shown or otherwise located without approval from the Contracting Officer.

### 3.1.10 Shoring

Provide shoring in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

## 3.2 TANK CONTENTS VERIFICATION

Conduct sampling and analysis in accordance with the approved Sampling and Analysis Plan. Submit reports, including the chain-of-custody records.

### 3.2.1 Sampling

Sample tank product, pumpable liquids, tank coatings and sludge. If the data is not adequate, additional sampling and analysis to the extent required by the approved offsite facility receiving the material is the responsibility of the Contractor. Meeting all regulatory requirements, including the preparation of hazardous materials and waste for



transportation, is the responsibility of the Contractor.

### 3.2.2 Analysis

Test tank contents for the parameters listed herein. Include [total petroleum hydrocarbons (TPH)] benzene, ethylbenzene, toluene and xylene (BETX) leadin the analysis.

### 3.2.3 Characterization

Prior to removing any of the tank contents, characterize the contents to determine the type of required disposal: in a special manner based on local, state, and Federal disposal regulations. Characterize tank product, pumpable liquids, and sludge in accordance with 40 CFR 261 and 40 CFR 279. Submit the waste contents determination and accompanying test results for each phase present in the tank to the Contracting Officer. The Contractor is responsible for any additional requirements identified by the disposal facility. Do not remove the tank contents until approval is given by the Contracting Officer.

## 3.3 CLEARING, GRUBBING AND REMOVALS

Perform clearing and grubbing in accordance with Section 31 11 00 CLEARING AND GRUBBING. Clear areas designated for clearing and grubbing as required and directed by the Contracting Officer of all trees, stumps, downed timber, brush, rubbish, roots larger than 3 inches in diameter, and matted roots prior to commencing operations. Saw cut concrete or asphalt pavement at the limits of removal and break, remove and dispose of the the resulting debris off Government Property. Dispose of offsite chain link fence.

## 3.4 TOPSOIL

Provide topsoil meeting the requirements in Section 31 00 00 EARTHWORK. Strip and stockpile uncontaminated topsoil separately for reuse at a location approved by the Contracting Officer if it meets the requirements of clean fill given in Paragraph BACKFILLING. Obtain additional topsoil in excess of that produced by excavation offsite . Cover with topsoil all areas disturbed by tank removal operations, other than areas to receive pavement or similar surface under this contract. Use topsoil wherever shown or stated on the drawings.

## 3.5 PREPARATIONS FOR EXCAVATION

Before excavating, drain product piping back to the tank and remove all product from the tank. Purge and vent the tank in accordance with API RP 1604, and as specified herein.

### 3.5.1 Removal of Product, Pumpable Liquids, and Sludge

Remove and dispose of tank product, pumpable liquids, and sludge. Use of Government facilities for permanent storage or disposal of the wastes is prohibited. Temporary storage on Government facilities will be allowed only until testing is complete, manifests (if necessary) are complete, and transportation is arranged. The Contractor is responsible for obtaining all required permits. Usable product is the property of the Government. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests and associated land disposal restriction notices and notifications, necessary for accomplishment of the work, including materials necessary for cleaning up spills that could occur from tank

removal operations.

### 3.5.2 Contaminated Water Disposal

#### 3.5.2.1 Sampling, Analysis, and Containment

Sample and analyze contaminated water both prior to and after treatment. Analyze contaminated water produced from excavation operations and tank pumping treated onsite, for pH; benzene, ethylbenzene, toluene, and xylene (BETX); total lead; oil and grease; total petroleum hydrocarbons (TPH). Perform sampling and analysis prior to disposal for every 50,000 gallons of contaminated water treated. Conform analysis of contaminated water to be taken to an offsite treatment facility to the requirements of the treatment facility, with documentation of all analyses performed furnished to the Contracting Officer in accordance with paragraph RECORDS. Contain, store onsite, and analyze contaminated water and dispose of in accordance with applicable Federal and state disposal regulations. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests and associated land disposal notices and notifications, necessary for accomplishment of the work.

#### 3.5.2.2 Treatment

Treat contaminated water offsite, or other means as approved by the Contracting Officer. If contaminated water is to be treated onsite, specify the proposed treatment in the Work Plan and submit for approval, including the chain-of-custody records. Install temporary storage and treatment equipment at a location approved by the Contracting Officer. Sample and analyze treated effluent and secure approval of results by the Contracting Officer before discharge to the surface. Treat and discharge effluent in accordance with the discharge permit.

### 3.6 PURGING AND INERTING

After the tank and piping contents have been removed, but prior to excavation beyond the top of the tank, disconnect all the piping (except the piping needed to purge or inert the tank). Purge flammable and toxic vapors from the tank or make the tank inert in accordance with API RP 1604, with the exception that filling with water is not permitted and, if dry ice is employed, use a minimum of 3 pounds per 100 gallons of tank volume. Continuously monitor the tank atmosphere for combustible vapors if the tank is purged, or continuously monitor for oxygen, if the tank is inerted.

### 3.7 EXCAVATION

Mark all excavation areas, as well as work near roadways, in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

#### 3.7.1 Exploratory Trenches

- a. Excavate exploratory trenches as necessary to determine the tank location, limits and the location of ancillary equipment. Upon commencing exploratory excavation, utilize organic vapor analyzer/flame ionization device (OVA/FID) equipment to obtain readings for total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylene (BTX), and toxicity characteristic leaching procedure (TCLP). If BTEX indicates gasoline, then provide TCLP.

- b. To determine soil contamination levels, continuously monitor soil materials excavated to remove tanks with an OVA/FID capable of detecting volatile organic vapors to a minimum of one ppm. Further test contaminated soils with OVA/FID readings of 10 ppm or greater for TPH and BTEX as specified herein. Soils with OVA/FID readings less than 10 ppm may be used as clean backfill. Dispose of contaminated soils in accordance with Federal, State, and local regulations.

### 3.7.2 Tank Excavation

- a. Provide Contracting Officer with written documentation, no later than 30 days before work begins, that proper State or local authorities have been notified. Notify the Contracting Officer at least 48 hours prior to start of tank removal work. Stage operations to minimize the time that tank excavation is open and the time that contaminated soil is exposed to the weather. Provide protection measures around the excavation area to prevent water runoff and to contain the soil within the excavation area.
- b. Perform excavation around the perimeter of the tank to limit the amount of potentially contaminated soil that could be mixed with previously uncontaminated soil. Segregate contaminated soil in separate stockpiles.
- c. Maintain an excavation around the tank of sufficient size to allow workers ample room to complete the work, but also protect the workers from sliding or cave-ins. Install sheeting, bracing, or shoring in the absence of adequate side slopes if there is a need for workers to enter the excavated area. Divert surface water to prevent direct entry into the excavation.
- d. Dewatering of the excavation may require a discharge permit by the State and is limited to allow adequate access to the tank and piping, to assure a safe excavation, and to ensure that compaction and moisture requirements are met during backfilling. Dewatering may result in the production of petroleum contaminated water and/or free product. Recover free product from the groundwater only as part of necessary dewatering.
- e. Collect and test water generated by dewatering during excavation required for removal of tanks or piping, surface water collected in open excavation, or water used for washing equipment or existing concrete or bituminous surfaces, in accordance with EPA 530-R-97-007, EPA 600/4-79/020, EPA SW-846 and state or locally required analyses.

### 3.7.3 Temporary Containment of Excavated Soil

Provide temporary containment area near the excavated area. Cover containment area with 30 mil polyethylene sheeting. Place excavated soil on the impervious barrier and cover with 6 mil polyethylene sheeting. Provide straw bale berm around the outer limits of the containment area and cover with polyethylene sheets. Secure edges of sheets to keep the polyethylene sheeting in place.

### 3.7.4 Piping Excavation

Perform excavation as necessary to remove tank piping and ancillary equipment in accordance with paragraphs: Shoring, Tank Excavation, and Open Excavations.

### 3.7.5 Open Excavations

Secure open excavations and stockpile areas while awaiting confirmation test results from the soil beneath the tank. Backfill the excavation as soon as possible after tank and contaminated soil removals have been completed and confirmation samples have been taken. Divert surface water around excavations to prevent water from directly entering into the excavation.

### 3.7.6 Hidden Structures

During excavation activities, if asphalt pavement, concrete slabs, or other hidden structures are encountered, remove and wash with high pressure water cleaning equipment. Remove and dispose of the pavement, concrete, and other structures as specified in Section 02 41 00 DEMOLITION.

### 3.7.7 Stockpiles

Separately stockpile uncontaminated soil from the contaminated soil, a safe distance away from, but adjacent to, the excavation..

### 3.7.8 Acceptable Levels of Contamination

Take further samples and test soils with OVA/FID readings of 10 ppm or greater for TPH and for BTEX in accordance with EPA SW-846 and EPA 600/4-79/020, and for toxicity characteristic leaching procedure (TCLP) for lead if leaded gasoline was stored in or near the underground tank being removed. For stockpiled soils, provide a minimum of one test for every 100 cubic yards for TPH, and one test for every 100 cubic yards for BTEX and TCLP. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX or have TCLP reading of 10 ppm lead or virgin petroleum products are considered contaminated materials. Soils which are less than the above may be used as clean fill. Furnish results to the Contracting Officer within 24 hours after the results are obtained.

## 3.8 REMOVAL OF PIPING, ANCILLARY EQUIPMENT, AND TANK

### 3.8.1 Piping and Ancillary Equipment

Disconnect all piping and ancillary equipment from the tank. Remove the piping as directed by the Contracting Officer. Cap all tank ancillary equipment and piping connections, except those connections necessary to inert the tank within the excavation zone. Clean the piping exterior and ancillary equipment to remove all soil and inspect for signs of corrosion and leakage. Ensure no spillage of the piping contents occurs, as specified in the Work Plan, and as required in paragraph SPILLS. If the soil under and around the tank pad is not contaminated, leave the tank pad in place.

### 3.8.2 Tank

Remove the tank from the excavation and clean the exterior to remove all soil and inspect for signs of corrosion, structural damage, or leakage. Use only non-sparking type materials or equipment which comes into contact with the tank, or in the vicinity of the excavation such as shovels, slings and tools. After removal from the excavation, place the tank on a level surface adjacent to the tank excavation and secure it with wood blocks to prevent movement.

### 3.8.3 Contaminated Soil, Tank and Piping Excavation Examination

- a. After the tank has been removed from the ground, examine and test the adjacent and underlying soil for any evidence of leakage. Visually inspect the soil for staining after removal of all obviously contaminated soil, then screen for the presence of contamination using a real time vapor monitoring instrument or an immunoassay field kits.
- b. If tank is 20 feet or less in length, take two samples. Take each sample 2 feet from each end of the tank and 2 feet below the bottom of the excavation.
- c. If the tank is greater than 20 feet, take three samples. Take two samples 2 feet from each end of the tank and 2 feet below the bottom of the excavation. Take a third sample from the middle of the tank area and 2 feet below the bottom of the excavation.
- d. Analyze samples for TPH, BTEX, and TCLP. Perform sampling and analysis conforming to standards specified above for stockpiled soils. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX, or have TCLP reading of 10 ppm of lead or virgin petroleum products are considered contaminated materials. Soils which are less than the above may be used as clean fill. Furnish results to the Contracting Officer within 24 hours after the results are obtained. Along with the results furnish a sketch showing underground tank, sampling location, and extent of excavations.
- e. Stockpile onsite in accordance with paragraph Stockpiles uncontaminated soil or petroleum contaminated soil not regulated by the state as hazardous waste. Stockpile contaminated soil or suspected contaminated soil, or, if the site is a RCRA-designated CAMU, containerized until further disposition.
- f. The Contracting Officer will determine the extent of the contaminated soil to be removed from each site. Report any evidence indicating that the amount of contaminated soil may exceed the individual site limit specified, to the Contracting Officer the same day it is discovered. If minimal additional excavation is required, the Contracting Officer may allow the Contractor to proceed. If extensive contamination is encountered, sample the excavation and backfill in accordance with paragraph BACKFILLING.

### 3.8.4 Testing Along Piping

For every 25 linear feet of product delivery piping, for every change in direction, and at every mechanical joint take one soil sample and analyze for TPH, BTEX, and TCLP. Conform sampling and analysis of soil materials to EPA standards specified above.

### 3.9 TANK CLEANING

Provide additional requirements for cleaning and vapor freeing tank as specified in Section 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS. Provide clean and vapor free tank in accordance with API RP 1604 and the following:

a. Table of Tank History						
Tank No.	Tank Location	Tank Capacity	Date Constructed	Type of Lining (If Applicable)	Type of Fuel	Remarks From the Last Inspection
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]

b. Fuel Removal: All possible fuel will be pumped or otherwise removed from the tank by the Government. Consider remaining fuel contaminated or waste fuel; pump into 55 gallon drums or other suitable containers for disposal in accordance with approved procedures meeting local, State, and Federal regulations. Dispose of remaining fuel emulsions in accordance with applicable local, State, and Federal regulations. Drums or tanks used for containerizing waste fuel will be furnished by the Contractor.

3.9.1 Exterior

Remove soil from the exterior of the tank, piping, and associated equipment to eliminate soil deposition on roadways during transportation to a temporary storage area, ensure markings will adhere to the surfaces, and simplify tank cutting. Use non-sparking tools to remove soil. Recover removed uncontaminated soil and soil not regulated by the state as a hazardous waste and use them as backfill in the former tank excavation. Remove and containerize soil believed to be contaminated, or if the site is a RCRA designated CAMU, collect it on 3 layers of 6 mil impermeable geomembrane and stockpile it with other contaminated soil removed from the excavation.

3.9.2 Temporary Storage

If the tank is stored after the tank exterior is cleaned and ancillary equipment is removed, and prior to being cut into sections, label the tank as directed in API RP 1604, place it on blocks, and temporarily store it on a flat area adjacent to the excavation. Prior to cleaning the tank interior, monitor the tank atmosphere for combustible vapors and purge or inert it if combustible vapors are detected. Provide warning labels as follows:

"TANK HAS CONTAINED LEADED GASOLINE

NOT VAPOR FREE

NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS

INTENDED FOR HUMAN OR ANIMAL CONSUMPTION

DATE OF REMOVAL: MONTH/DAY/YEAR"

Make tank unusable for future use, then transport and dispose of tank in accordance with Federal, State, and local regulations.

3.9.3 Interior

Clean tank interior using a high pressure (greater than 500 psi), low volume (less than 2 gpm) water spray. Also clean the interior surfaces of piping, to the extent possible, using the same method used for cleaning the tank. Contaminated water generated from interior cleaning operations (of both piping and tank) must not exceed the following quantities for each UST cleaned:

UST VOLUME (GALLONS)	PERCENT OF UST VOLUME
1,000 or less	5
10,000 or less	5 or 100 gal., whichever is less
20,000 or less	1 or 150 gal., whichever is less
greater than 20,000	1 or 250 gal., whichever is less

Handle in accordance with paragraph Contaminated Water Disposal all contaminated water resulting from cleaning operations. Clean so as to eliminate, to the greatest extent possible, the need for personnel to enter the tank. Use specially designed tank cleaning equipment which allows the tank to be cleaned prior to cutting into sections without requiring personnel to enter the tank or, if less specialized equipment is used, partially dissect the tank to overcome confined space entry hazards. Accomplish this work in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

3.10 SOIL EXAMINATION, TESTING, AND ANALYSIS

3.10.1 Tank Excavation Sampling Procedures

After soil known to be contaminated has been removed or after soil excavation is complete, sample the excavation with procedures, number, location, and methodology in accordance with state regulations.

3.10.2 Stockpiled Material Sampling

Sample and preserve stockpiled contaminated soil in accordance with the approved Sampling and Analysis Plan.

3.10.3 Analysis

Test soil samples from the excavation and stockpiled material in accordance with the approved Sampling and Analysis Plan for the following parameters: total petroleum hydrocarbon (TPH) benzene, ethylbenzene, toluene, xylene (BETX) toxicity characteristic leaching procedure (TCLP). Submit copies of all test results, including the chain-of-custody records, to the Contracting Officer.

3.11 BACKFILLING

- a. Backfill the tank area and any other excavations only after the soil test results have been approved. Complete contaminated soil removal after the bottom of the tank excavation is determined to have soil contamination levels below the state standards of 100 ppm TPH and

approval by the Contracting Officer.

- b. Dewater the excavation if necessary. Use stockpiled material, subjected to chemical confirmation testing as backfill, if it is found to contain less than 100 ppm of total petroleum hydrocarbons (TPH) and contain less than 10 ppm of BETX. Place clean backfill in layers with a maximum loose thickness of 8 inches, compacted to 90 percent maximum density for cohesive soils and 95 percent maximum density for cohesionless soils. Perform density tests using an approved commercial testing laboratory or by facilities furnished by the Contractor. Attach test results to Contractor's Quality Control Report; submit the report for each UST site opened, within 14 days of completing work at each site. Label each binder with contract number, project name, location and tank number; index each binder. Furnish a copy of the report to the Installation Environmental Coordinator.. Perform a minimum of 1 density test on each lift. Determine laboratory tests for moisture density relations in accordance with ASTM D1557, Method B, C, or D, or ASTM D6938. A mechanical tamper may be used, provided that the results are correlated with those obtained by the hand tamper. Determine field in-place density in accordance with ASTM D1556/D1556M, ASTM D6938, or ASTM D2167.

### 3.12 DISPOSAL REQUIREMENTS

#### 3.12.1 Treatment, Disposal, and Recycling

Perform disposal of [hazardous] [or] [special] wastes in accordance with all local, State, and Federal solid and hazardous waste laws and regulations; the RCRA; Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS; and conditions specified herein. This work includes all necessary personnel, labor, transportation, packaging, detailed analyses (if required for disposal, manifesting or completing waste profile sheets), equipment, and reports. Recycle product and pumpable liquids removed from the tank to the greatest extent practicable. Dispose of the tanks removed at one of the following state approved facilities: [\_\_\_\_]. Provide manifest for each tank disposed of in this manner as required by the State of [\_\_\_\_] to document delivery and acceptance at the disposal facility.

#### 3.12.2 Tank and Ancillary Equipment Disposal

After the tank, piping, and ancillary equipment have been removed from the excavation and the tank cleaned, cut the tank into sections with no dimension greater than 5 feet. Dispose of tank and piping sections in a State approved offsite disposal facility. Perform tank cutting prior to being taken off Government property. Do not sell the tank intact. Dispose of ancillary equipment at an approved offsite disposal facility. Disconnect piping from the tank and remove unless otherwise indicated.

#### 3.12.3 Transportation of Wastes

Provide transportation in accordance with Department of Transportation (DOT) Hazardous Material Regulations and State and local requirements, including obtaining all necessary permits, licenses, and approvals. Submit evidence that a State licensed [hazardous] waste transporter is being used.

#### 3.12.4 Salvage Rights

The Contractor retains the rights to salvage value of recycled or reclaimed



product and metal not turned in to the DRMO or otherwise identified, so long as the requirements of 40 CFR 266 and 40 CFR 279, or the applicable State requirements are met. At the end of the contract, provide documentation on the disposition of salvaged materials.

#### 3.12.5 Manifest Records

Maintain records of all waste determinations, including appropriate results of analyses performed, substances and sample location, the time of collection, and other pertinent data as required by 40 CFR 280, Section 74 and 40 CFR 262 Subpart D. Also record transportation, treatment, disposal methods and dates, the quantities of waste, the names and addresses of each transporter and the disposal or reclamation facility, and availability of inspection, as well as copies of the following documents:

- a. Manifests.
- b. Waste analyses or waste profile sheets.
- c. Certifications of final treatment/disposal signed by the responsible disposal facility official.
- d. Land disposal notification records required under 40 CFR 268 for hazardous wastes.

Provide records in accordance with Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Upon contract close out, the records will become the property of the Government.

#### 3.12.6 Hazardous/Special Waste Manifests

Provide manifesting conforming to the requirements specified in Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

#### 3.12.7 Documentation of Treatment or Disposal

Take wastes, other than recyclable or reclaimable product or metal, to a treatment, storage, or disposal facility which has EPA or appropriate state permits and hazardous or special waste identification numbers and complies with the provisions of the disposal regulations. Furnish documentation of acceptance of special waste by a facility legally permitted to treat or dispose of those materials to the Contracting Officer not later than 5 working days following the delivery of those materials to the facility; and include a copy in the Tank Closure Report. Furnish a statement of agreement from the proposed treatment, storage or disposal facility and certified transporters to accept hazardous or special wastes to the Contracting Officer not less than 14 days before transporting any wastes. If the Contractor selects a different facility than is identified in the Work Plan, provide documentation for approval to certify that the facility is authorized and meets the standards specified in 40 CFR 264.

#### 3.13 SPILLS

Use appropriate vehicles and operating practices to prevent spillage or leakage of contaminated materials from occurring during operations. Inspect vehicles leaving the area of contamination to ensure that no contaminated materials adhere to the wheels or undercarriage. Take immediate containment actions as necessary to minimize effect of any spill or leak. Cleanup in accordance with applicable Federal, State, local laws

and regulations, and district policy at no additional cost to the Government. Refer to Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS for spill response and reporting requirements.

### 3.14 INSPECTIONS

Arrange for and perform required inspections. Provide copies of inspections to Contracting Officer.

### 3.15 TANK CLOSURE REPORT

Submit a Site Assessment/Tank Closure Report in a single binder notebook containing a collection of reports, records, starting and ending dates of reporting period, inspections, documentation, and data as follows:

- a. Complete UST Notification Form (within 30 days of closure).
- b. Description of work, including removal procedures, number of tanks removed, identification of tanks removed and disposed of (include site map showing location of tank and piping), cubic yards of excavated soil, location of disposal sites, and dates of excavation.
- c. Site plan, including location of tanks and piping, limits of excavation, sampling points, results of excavation, and depths.
- d. Laboratory and field testing reports, copies of data and test results from testing laboratory and the chain-of-custody records.
- e. Tank disposal paperwork, contaminated soil disposal paperwork (include laboratory testing reports), and contaminated water disposal paperwork (include laboratory testing reports).
- f. Certifications required by implementing agency.
- g. Inspection permits and other permits required for underground tank removal, notifications, and inspection reports.
- h. Cumulative quantities of soil excavated, beginning with start date for each tank and associated piping.

### 3.16 COMPACTION, FINISH GRADING, and SEEDING

Provide backfill, compaction, grading, and seeding in accordance with Section 31 00 00 EXCAVATION. Line the excavation with two plastic sheets before backfilling.

-- End of Section --

## SECTION 02 81 00

## TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS

11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)

IATA DGR (2018) Dangerous Goods Regulations

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 415-1-266 (2000) Construction -- Resident Engineer Management Guide (REMG) for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects

## U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT 4500.9R Defense Transportation Regulation, Part 2, Cargo Movement, Chapter 204, Hazardous Material

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 266 Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

40 CFR 268 Land Disposal Restrictions

40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

## 1.2 DEFINITIONS

### 1.2.1 Hazardous Material

A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section 1801 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.

### 1.2.2 Hazardous Waste

A waste which meets criteria established in RCRA or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Packaging Notifications

Hazardous Waste Management Plan; G

Onsite Hazardous Waste Management; G

Notices of Non-Compliance and Notices of Violation

#### SD-06 Test Reports

Recordkeeping; G

Exception Report; G

Spill Response

#### SD-07 Certificates

Transportation and Disposal Coordinator; G

Training; G

Certification

Shipping Documents and Packagings Certification; G

Security Plan

Certificates of Disposal

Waste Minimization

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Transportation and Disposal Coordinator

Designate, by position and title, one person to act as the Transportation and Disposal Coordinator (TDC) for this contract. The TDC must serve as the single point of contact for all environmental regulatory matters and have overall responsibility for total environmental compliance at the site including, but not limited to, accurate identification and classification of hazardous waste and hazardous materials; determination of proper shipping names; identification of marking, labeling, packaging and placarding requirements; completion of waste profiles, hazardous waste manifests, asbestos waste shipment records, PCB manifests, bill of lading, exception and discrepancy reports; and all other environmental documentation. The TDC must have, at a minimum, one year of specialized experience in the management and transportation of hazardous waste and have been Department of Transportation certified under [49 CFR 172](#), Subpart H.

#### 1.4.2 Training

Hazardous materials employees must be trained, tested, and certified to safely and effectively carry out their assigned duties in accordance with Section [01 35 29.13](#) HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES. Employees transporting hazardous materials or preparing hazardous materials for transportation, including samples, must be trained, tested, and certified in accordance with [49 CFR 172](#), Subpart H, including security awareness and any applicable security plans. Hazardous material employees must also be trained in accordance with [IATA DGR](#) when

shipping hazardous materials by air. Employees must be trained, tested, and certified in accordance with 49 CFR 172, Subpart H to determine that shipments do not constitute DOT regulated hazardous materials.

#### 1.4.3 Certification

The hazardous materials transporter must possess a current certificate of registration issued by the Research and Special Programs Administration (RSPA), U.S. Department of Transportation, when required by 49 CFR 107, Subpart G. Submit copies of the certificates or written statements certifying exemption from these requirements.

#### 1.4.4 Laws and Regulations Requirements

Comply with Federal, state, and local laws and regulations which are applicable. These requirements are amended frequently and compliance with amendments is required as they become effective. Notify the Contracting Officer immediately if compliance exceeds the scope of work or conflicts with specific requirements of the contract.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Provide all the materials required for the packaging, labeling, marking, placarding and transportation of hazardous wastes and hazardous materials in conformance with Department of Transportation standards EP 415-1-266. Details in this specification must not be construed as establishing the limits of the Contractor's responsibility.

##### 2.1.1 Packagings

Provide bulk and non-bulk containers for packaging hazardous materials/wastes consistent with the authorizations referenced in the Hazardous Materials Table in 49 CFR 172, Section.101, Column 8. Bulk and non-bulk packaging must meet the corresponding specifications in 49 CFR 173 referenced in the Hazardous Materials Table, 49 CFR 172, Section .101. Packaging must conform to the general packaging requirements of Subpart B of 49 CFR 173, to the requirements of 49 CFR 178 at the specified packing group performance level, to the requirements of special provisions of column 7 of the Hazardous Materials Table in 49 CFR 172, Section .101, and be compatible with the material to be packaged as required by 40 CFR 262. Also provide other packaging related materials such as materials used to cushion or fill voids in overpacked containers. The hazardous materials being packaged must not react dangerously with, decompose or ignite the sorbent packaging materials. Additionally, sorbents used to treat free liquids to be disposed of in landfills must be non-biodegradable as specified in 40 CFR 264, Section .314. In addition, packaging notifications will be provided to the Government in accordance with 49 CFR 172, Section .178.2(c) regarding type and dimensions of closures, including gaskets, needed to satisfy performance test requirements.

##### 2.1.2 Markings

Provide markings for each hazardous material/waste package, freight container, and transport vehicle consistent with the requirements of 49 CFR 172, Subpart D and 40 CFR 262, Section.32 (for hazardous waste). Markings must withstand a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation, without

deterioration or substantial color change.

### 2.1.3 Labeling

Provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in [49 CFR 172](#), Section .101, Column 6. Labels must meet design specifications required by [49 CFR 172](#), Subpart E including size, shape, color, printing, and symbol requirements. Labels must be durable weather resistant and withstanding a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation, without deterioration or substantial color change.

### 2.1.4 Placards

For each offsite shipment of hazardous material/waste, provide primary and subsidiary placards consistent with the requirements of [49 CFR 172](#), Subpart F. Provide placards for each side and each end of bulk packaging, freight containers, transport vehicles, and rail cars requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and must meet design requirements specified in [49 CFR 172](#), Subpart F.

### 2.1.5 Spill Response Materials

Provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials must be available at all times when hazardous materials/wastes are being handled or transported. Spill response materials must be compatible with the type of material being handled.

## 2.2 EQUIPMENT AND TOOLS

Provide miscellaneous equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner.

## PART 3 EXECUTION

### 3.1 HAZARDOUS WASTE MANAGEMENT PLAN

Prepare a Hazardous Waste Management Plan detailing the manner in which hazardous wastes will be managed and describing the types and volumes of hazardous wastes anticipated to be managed. The plan must address both onsite and offsite hazardous waste management. Describe the methods to be used to ensure accurate piece counts or weights of shipments; describe waste minimization methods; identify and describe facilities to be used for treatment, storage, and disposal (TSD); identify areas onsite where hazardous wastes are to be handled; and identify whether transfer facilities are to be used; and if so, how the wastes will be tracked to ultimate disposal. Submit the plan to the Contracting Officer for approval prior to start of work. Submit written documentation of weekly hazardous waste inspections on a monthly basis.

### 3.2 ONSITE HAZARDOUS WASTE MANAGEMENT

Coordinate the onsite management of all hazardous materials and waste with the installation environmental function and the Contracting Officer. These paragraphs apply to Government owned waste only. The Contractor is responsible for ensuring compliance with Federal, state, and local

hazardous waste laws and regulations and verifying those requirements when preparing reports, waste shipment records, hazardous waste manifests, or other documents. Identify hazardous wastes using criteria set forth in 40 CFR 261 or applicable state and local laws, regulations, and ordinances. Comply with generator requirements in 40 CFR 262 and applicable state or local law or regulations when accumulating hazardous waste onsite. Onsite accumulation times must be restricted to applicable time frames referenced in 40 CFR 262, Section.34 and applicable state or local law or regulation. Accumulation start dates commence when waste container is transferred into a 90 day accumulation site or permitted storage facility. Only use containers in good condition and compatible with the waste to be stored. Ensure containers are closed except when adding or removing waste, and immediately mark all hazardous waste containers with the words "hazardous waste" and other information required by 40 CFR 262, Section.32 and applicable state or local law or regulation as soon as the waste is containerized. An additional marking must be placed on containers of "unknowns" designating the date sampled, and the suspected hazard. Inspect containers for signs of deterioration and for responding to any spills or leaks. Inspect all hazardous waste areas weekly and provide written documentation of the inspection. Include date and time of inspection, name of individual conducting the inspection, problems noted, and corrective actions taken on the inspection logs.

### 3.2.1 Hazardous Waste Classification

Identify, in consultation with the Contracting Officer, all waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or applicable state or local law or regulation. Also identify applicable treatment standards in 40 CFR 268 and state land disposal restrictions and make a determination as to whether or not the waste meets or exceeds the standards. Submit waste profiles, analyses, classification and treatment standards information to Contracting Officer for review and approval.

### 3.3 OFFSITE HAZARDOUS WASTE MANAGEMENT

Coordinate the off site transfer of all hazardous materials and waste with the installation environmental function and the Contracting Officer. Use RCRA Subtitle C permitted facilities which meet the requirements of 40 CFR 264 or facilities operating under interim status which meet the requirements of 40 CFR 265. Do not use offsite treatment, storage, and disposal facilities with significant RCRA violations or compliance problems (such as facilities known to be releasing hazardous constituents into ground water, surface water, soil, or air). Submit [Notices of Non-Compliance and Notices of Violation](#) by a Federal, state, or local regulatory agency issued to the Contractor in relation to any work performed under this contract. Immediately provide copies of such notices to the Contracting Officer. Also furnish relevant documents regarding the incident and any information requested by the Contracting Officer, and coordinate its response to the notice with the Contracting Officer or the designated representative prior to submission to the notifying authority. Also furnish a copy to the Contracting Officer of all documents submitted to the regulatory authority, including the final reply to the notice, and all other materials, until the matter is resolved.

#### 3.3.1 Treatment, Storage, and Disposal Facility and Transporter

Provide the Contracting Officer with EPA ID numbers, names, locations, and telephone numbers of TSD facilities and transporters. This information



must be contained in the Hazardous Waste Management Plan and be approved by the Contracting Officer prior to waste disposal.

### 3.3.2 Facility Status Information

Facilities receiving hazardous waste must be permitted in accordance with [40 CFR 270](#) or operating under interim status in accordance with [40 CFR 265](#) requirements, or permitted by a state authorized by the Environmental Protection Agency to administer the RCRA permit program. Additionally, prior to using a TSD Facility, contact the EPA Regional Offsite Coordinator specified in [40 CFR 300](#), Section .440, to determine the facility's status, and document all information necessary to satisfy the requirements of the EPA Offsite policy and submit this information to the Contracting Officer in the Hazardous Waste Management Plan.

### 3.3.3 Shipping Documents and Packagings Certification

Prior to shipment of any hazardous material offsite and a minimum of 14 days prior to anticipated pickup, provide for review written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation and EPA requirements. Furnish designated disposal facility packaging assurances not later than 35 days after acceptance of the shipment. The Contractor's TDC must also provide written certification regarding waste minimization efforts documenting that efforts have been taken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

### 3.3.4 Transportation

Prior to conducting hazardous materials activities, the Contractor responsible for pre-transportation activities must either certify to the Government that a [Security Plan](#) is in place which meets the requirements of [49 CFR 172](#), Subpart I or in the event that the types or amounts of hazardous materials are excluded from the security planning requirements, a written statement to that effect detailing the basis for the exception. Use manifests for transporting hazardous wastes as required by [40 CFR 263](#) or applicable state or local law or regulation. Transportation must comply with all requirements in the Department of Transportation referenced regulations in the 49 CFR series. Prepare hazardous waste manifests for each shipment of hazardous waste shipped offsite. Complete manifests using instructions in [40 CFR 262](#), Subpart B and applicable state or local law or regulation. Submit manifests and waste profiles to Contracting Officer for review and approval. Prepare land disposal restriction notifications as required by [40 CFR 268](#) or applicable state or local law or regulation for each shipment of hazardous waste. Submit notifications with the manifest to the Contracting Officer for review and approval. In accordance with [DOT 4500.9R](#), inspect motor vehicles used to transport hazardous materials in accordance the 49 CFR and DOT safety regulations and complete DDForm 626, Motor Vehicle Inspection.

### 3.3.5 Treatment and Disposal of Hazardous Wastes

Coordinate any off site shipments of hazardous materials or hazardous wastes with the installation environmental function. Initial, or satellite hazardous waste accumulation is limited to 55 gallons (or 1 quart of acutely hazardous waste). Once a waste stream exceeds 55 gallons, it must be transferred to an on-site 90 day (180 day small quantity generator)

accumulation area, or a permitted hazardous waste treatment, storage or disposal facility within three days. Ship hazardous wastes only to facilities which are properly permitted to accept the hazardous waste or operating under interim status. Ensure wastes are treated to meet land disposal treatment standards in [40 CFR 268](#) prior to land disposal. Propose TSD facilities via submission of the Hazardous Waste Management Plan, subject to the approval of the Contracting Officer. Submit [Certificates of Disposal](#) documenting within 180 days of initial shipment. Receipt of these certificates will be required for final payment.

### 3.4 RADIOACTIVE MATERIALS MANAGEMENT

Consult with the Contracting Officer, to evaluate, prior to shipment of any material offsite, whether the material is regulated as a hazardous waste in addition to being regulated as a radioactive material. Perform the evaluation to determine proper shipping descriptions, marking requirements, and other criteria, as described below.

#### 3.4.1 Identification of Proper Shipping Names

Use [49 CFR 172](#), Section .101 to identify proper shipping names for each hazardous material (including hazardous wastes) to be shipped offsite. Submit proper shipping names to the Contracting Officer in the form of draft shipping documents for review and approval.

#### 3.4.2 Packaging, Labeling, and Marking

Package, label, and mark hazardous materials/wastes using the specified materials and in accordance with the referenced authorizations. Mark each container of hazardous waste of [110 gallons](#) or less with the following:

"HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal.

If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.

Generator's name \_\_\_\_\_

Manifest Document Number \_\_\_\_\_".

#### 3.4.3 Shipping Documents

Ensure that each shipment of hazardous material sent offsite is accompanied by properly completed shipping documents. This includes shipments of samples that may potentially meet the definition of a Department of Transportation regulated hazardous material.

##### 3.4.3.1 PCB Waste Shipment Documents

Prepare hazardous waste manifests for each shipment of PCB waste shipped offsite. Complete manifests using instructions in [40 CFR 761](#), Sections .207 and .208 and other applicable requirements. Submit documents to Contracting Officer for review and approval.

##### 3.4.3.2 Asbestos Waste Shipment Documents

Prepare waste shipment records, as required by [40 CFR 61](#), for shipments of asbestos. Submit waste shipment records to the Contracting Officer for review and approval. Waste shipment records must be signed by the Contractor.

##### 3.4.3.3 Other Hazardous Material Shipment Documents

Prepare a bill of lading for each shipment of hazardous material which is not accompanied by a hazardous waste manifest or asbestos waste shipment record which fulfills the shipping paper requirements. The bill of lading must satisfy the requirements of 49 CFR 172, Subpart C, and 40 CFR 279 if shipping used oil and applicable state or local law or regulation, and must be submitted to the Contracting Officer for review and approval. For laboratory samples and treatability study samples, prepare bills of lading and other documentation as necessary to satisfy conditions of the sample exclusions in 40 CFR 261, Section .4(d) and (e) and any applicable state or local law or regulation. Bill of ladings requiring shipper's certifications must be signed by the Contractor.

### 3.5 SPECIAL REQUIREMENTS FOR ASBESTOS WASTES

If work involves asbestos containing wastes, manage these wastes in accordance with specification Section 02 82 00 ASBESTOS REMEDIATION.

### 3.6 WASTE MINIMIZATION

Minimize the generation of hazardous waste to the maximum extent practicable and take all necessary precautions to avoid mixing clean and contaminated wastes. Identify and evaluate recycling and reclamation options as alternatives to land disposal. Requirements of 40 CFR 266 apply to: hazardous wastes recycled in a manner constituting disposal; hazardous waste burned for energy recovery; lead-acid battery recycling; and hazardous wastes with economically recoverable precious metals. Submit written certification that waste minimization efforts have been undertaken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

### 3.7 RECORDKEEPING

Maintain adequate records to support information provided to the Contracting Officer regarding exception reports, annual reports, and biennial reports; maintain asbestos waste shipment records for a minimum of 3 years from the date of shipment or any longer period required by applicable law or regulation or other provision of this contract; and maintain bill of ladings for a minimum of 375 days from the date of shipment or longer period required by applicable law or regulation or other provision of this contract. Submit information necessary to file state annual or EPA biennial reports for hazardous waste transported, treated, stored, or disposed of under this contract. Do not forward these data directly to the regulatory agency but to the Contracting Officer at the specified time. Submit the information necessary for filing of the formal reports in the form and format required by the governing Federal or state regulatory agency. A cover letter must accompany the data to include the contract number, Contractor name, and project location. In the events that a manifest copy documenting receipt of hazardous waste at the treatment storage and disposal facility is not received within 35 days of shipment initiation, or that a manifest copy documenting receipt of PCB waste at the designated facility is not received within 35 days of shipment initiation, prepare and submit an [exception report](#) to the Contracting Officer within 37 days of shipment initiation.

### 3.8 SPILL RESPONSE

In the event of a spill or release of a hazardous substance (as designated

in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), notify the Contracting Officer immediately. Direction from the Contracting Officer concerning a spill or release is not considered a change under the contract. If the spill exceeds a reporting threshold, follow the pre-established procedures for immediate reporting to the Contracting Officer. Comply with applicable requirements of Federal, state, or local laws or regulations regarding any spill incident.

### 3.9 EMERGENCY CONTACTS

Comply with the emergency contact provisions in 49 CFR 172, Section .604. Whenever the Contractor ships hazardous materials, provide a 24 hr emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. Monitor the phone on a 24 hour basis at all times when the hazardous materials are in transportation, including during storage incidental to transportation. Ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. Designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

- a. The name of the emergency coordinator.
- b. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.
- c. The telephone number of the local fire department.
- d. The location of fire extinguishers and spill control materials.

Attachment A SAMPLE OFF-SITE POLICY CERTIFICATION MEMO	
Project/Contract #:	
Waste Stream:	
Primary TSD Facility, EPA ID #	
Alter. TSD Facility, EPA ID # and	
EPA Region	Contact
I	888-372-7341
II	212-673-4040
III	800-438-2474 or 215-814-5000
IV	800-241-1754 or 404-562-9900
V	312-353-2000
VI	800-887-6063 or 214-665-2210
VII	800-223-0425
VIII	800-424-8802
IX	415-947-8713
X	800-424-4372 or 206-553-4973
EPA representative contacted:	
EPA representative phone number:	
Date contacted:	
Comment:	
The above EPA representative was contacted on _____. As of that date the above sites were considered acceptable in accordance with the Off-Site Policy in 40 CFR 300.440.	
Date:	Signature:
Phone number:	

-- End of Section --

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## SECTION 02 82 00

## ASBESTOS REMEDIATION

11/18, CHG 1: 11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2 (2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

## ASTM INTERNATIONAL (ASTM)

ASTM C732 (2017; R 2022 Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants

ASTM D522/D522M (2017) Mandrel Bend Test of Attached Organic Coatings

ASTM D2794 (1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D4397 (2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E96/E96M (2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

ASTM E119 (2020) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E736/E736M (2017) Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

ASTM E1368 (2014) Visual Inspection of Asbestos Abatement Projects

ASTM E1494 (2012) Encapsulants for Spray- or Trowel-Applied Friable Asbestos-Containing

## Building Materials

## COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7 (2014) Compressed Air for Human  
Respiration; 6th Edition

## INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1 (2020) Occupational and Educational  
Personal Eye and Face Protection Devices

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2019) Standard Methods of Fire Tests for  
Flame Propagation of Textiles and Films

## NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH NMAM (2016; 5th Ed) NIOSH Manual of Analytical  
Methods

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health  
Requirements Manual

## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018 (1990) Asbestos/NESHAP Regulated Asbestos  
Containing Materials Guidance

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147 The Control of Hazardous Energy (Lock  
Out/Tag Out)

29 CFR 1926.51 Sanitation

29 CFR 1926.59 Hazard Communication

29 CFR 1926.103 Respiratory Protection

29 CFR 1926.200 Accident Prevention Signs and Tags

29 CFR 1926.1101 Asbestos

40 CFR 61-SUBPART A General Provisions

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 763 Asbestos

42 CFR 84 Approval of Respiratory Protective Devices

49 CFR 107 Hazardous Materials Program Procedures

49 CFR 171 General Information, Regulations, and  
Definitions



49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

ND OPNAVINST 5100.23 (2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 ACM

Asbestos Containing Materials.

1.2.2 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 0.00042 psi.

1.2.3 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one percent.

1.2.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.7 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

#### 1.2.8 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

#### 1.2.9 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

#### 1.2.10 Competent Person (CP)

A person meeting the requirements for competent person as specified in 29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent. The competent person must have a current State of Georgia asbestos contractors or supervisors license.

#### 1.2.11 Contractor

The Contractor is that individual, or entity under contract to perform the herein listed work.

#### 1.2.12 Disposal Bag

A 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

#### 1.2.13 Disturbance

Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in one standard sized glovebag or waste bag, not larger than 60 inches in length and width in order to access a building component.

#### 1.2.14 Encapsulation

The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.

#### 1.2.15 Encapsulants

Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

- a. Removal Encapsulant (can be used as a wetting agent)
- b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)
- c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)
- d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

#### 1.2.16 Friable Asbestos Material

A term defined in [40 CFR 61-SUBPART M](#) and [EPA 340/1-90/018](#) meaning any material which contains more than 1 percent asbestos, as determined using the method specified in [40 CFR 763](#), Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

#### 1.2.17 Glovebag Technique

Those asbestos removal and control techniques put forth in [29 CFR 1926.1101](#).

#### 1.2.18 Government Consultant (GC)

That qualified person employed directly by the Government to monitor, sample, inspect the work or in some other way advise the Contracting Officer. The GC is normally a private consultant, but can be an employee of the Government.

#### 1.2.19 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters must retain 99.97 percent of particles 0.3 microns or larger as indicated in [UL 586](#).

#### 1.2.20 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in [40 CFR 763](#).

#### 1.2.21 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in [29 CFR 1926.1101](#).

#### 1.2.22 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at [40 CFR 61-SUBPART M](#).

#### 1.2.23 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos

is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

#### 1.2.24 Permissible Exposure Limits (PELs)

##### 1.2.24.1 PEL-Time Weighted Average (TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8-hour time weighted average (TWA).

##### 1.2.24.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

#### 1.2.25 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with [29 CFR 1926.1101](#).

#### 1.2.26 Private Qualified Person (PQP)

That qualified person hired by the Contractor to perform the herein listed tasks.

#### 1.2.27 Qualified Person (QP)

A Registered Architect, Professional Engineer, Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan as described in [40 CFR 763](#) as a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer; and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The QP must be qualified to perform visual inspections as indicated in [ASTM E1368](#). The QP must be appropriately licensed in the State of [Georgia](#).

#### 1.2.28 TEM

Refers to Transmission Electron Microscopy.

#### 1.2.29 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

#### 1.2.30 Transite

A generic name for asbestos cement wallboard and pipe.

#### 1.2.31 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most

0.00042 psi.

### 1.2.32 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation, if required by the OSHA Class of work to be performed or by the state where the work is to be performed. The worker must be appropriately licensed in the State of Georgia.

## 1.3 REQUIREMENTS

### 1.3.1 Description of Work

The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures must be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification.. Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein. Provide negative pressure enclosure techniques as outlined in this specification. The work area will be evacuated during the asbestos abatement work. A competent person must supervise asbestos removal work as specified herein.

### 1.3.2 Unexpected Discovery of Asbestos

Notify the Contracting Officer if any previously untested building components suspected to contain asbestos are impacted by the work.

### 1.3.3 Medical Requirements

Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

#### 1.3.3.1 Medical Examinations

Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination must be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."

#### 1.3.3.2 Medical Records

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of [50 years][indefinite time] after termination of employment and make records of the required

medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

#### 1.3.4 Employee Training

Submit certificates, prior to the start of work but after the main abatement submittal, signed by each employee indicating that the employee has received training in the proper handling of materials and wastes that contain asbestos in accordance with 40 CFR 763; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis. Organize certificates by individual worker, not grouped by type of certification. Post appropriate evidence of compliance with the training requirements of 40 CFR 763. Train personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. Document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer. Furnish each employee with respirator training and fit testing administered by the PQP as required by 29 CFR 1926.1101 and 29 CFR 1926.103. Fully cover engineering and other hazard control techniques and procedures. Asbestos workers must have a current State of Georgia asbestos worker's license.

#### 1.3.5 Permits, Licenses, and Notifications

Prior to the start of work, obtain necessary permits and licenses in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by Federal, State, regional, and local authorities. Notify the Contracting Officer and other appropriate Government agencies in writing 20 working days prior to the start of asbestos work as indicated in applicable laws, ordinances, criteria, rules, and regulations. Submit copies of all Notifications to the Contracting Officer.

#### 1.3.6 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of EM 385-1-1, 29 CFR 1926.1101, 40 CFR 61-SUBPART A, 40 CFR 61-SUBPART M, 40 CFR 763 and ND OPNAVINST 5100.23. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government apply.

#### 1.3.7 Respiratory Protection Program

Establish and implement a respirator program as required by 29 CFR 1926.1101, and 29 CFR 1926.103. Submit a written description of the program to the

Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

#### 1.3.7.1 Respirator Program Records

Submit records of the respirator program as required by [29 CFR 1926.103](#), and [29 CFR 1926.1101](#).

#### 1.3.7.2 Respirator Fit Testing

The Contractor's PQP must conduct a qualitative or quantitative fit test conforming to [29 CFR 1926.103](#) for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

#### 1.3.7.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by [29 CFR 1926.1101](#) and in accordance with [CGA G-7](#) and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of [42 CFR 84](#), for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

#### 1.3.8 Asbestos Hazard Control Supervisor

The Contractor must be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

#### 1.3.9 Hazard Communication

Adhere to all parts of [29 CFR 1926.59](#) and provide the Contracting Officer with a copy of the [Safety Data Sheets \(SDS\)](#) for all materials brought to the site.

#### 1.3.10 Asbestos Hazard Abatement Plan

Submit a detailed plan of the safety precautions such as lockout, tagout, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the encapsulation removal and demolition of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, must be prepared, signed, and sealed by the PQP. Provide a Table of Contents for each abatement submittal, which follows the sequence of requirements in the contract. The plan must include but not be limited to the precise personal protective equipment to be used including, but not limited to, respiratory protection, type of whole-body protection[ and if reusable coveralls are to be employed decontamination methods (operations and quality control plan)], the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage

areas, change rooms, removal, encapsulation method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan must also include (both fire and medical emergency) response plans and an Activity Hazard Analyses (AHAs) in accordance with EM 385-1-1. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor, CP and PQP must meet with the Contracting Officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan must be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

#### 1.3.11 Testing Laboratory

Submit the name, address, and telephone number of each testing laboratory selected for the [ sampling, ] analysis, and reporting of airborne concentrations of asbestos fibers along with [ evidence that each laboratory selected holds the appropriate State license and permits and ] certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The testing laboratory firm must be independent of the asbestos contractor and must have no employee or employer relationship which could constitute a conflict of interest.

#### 1.3.12 Landfill Approval

Submit written evidence that the landfill is approved for asbestos disposal by the U.S. Environmental Protection Agency, Region [3] [\_\_\_\_], Air Enforcement Section [(38W12)] [\_\_\_\_], and local regulatory agencies. Within three working days after delivery, submit detailed [delivery tickets](#), prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the [waste shipment records](#) within one day of the shipment leaving the project site.

#### 1.3.13 Transporter Certification

Submit written evidence that the transporter is approved to transport asbestos waste in accordance with the DOT requirements of [49 CFR 171](#), [49 CFR 172](#) and [49 CFR 173](#) as well as registration requirements of [49 CFR 107](#) and all other State and local regulatory agency requirements.

#### 1.3.14 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in



29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work but after the main abatement submittal.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-03 Product Data

Amended Water; G

Safety Data Sheets (SDS) for All Materials; G

Encapsulants; G

Respirators; G

Local Exhaust Equipment; G

Pressure Differential Automatic Recording Instrument; G

Vacuums; G

[ Glovebags; G

] SD-06 Test Reports

Air Sampling Results; G

Pressure Differential Recordings for Local Exhaust System; G

[ Encapsulation Test Patches; G

] Clearance Sampling; G

Asbestos Disposal Quantity Report; G

##### SD-07 Certificates

Employee Training; G

Notifications; G

Respiratory Protection Program; G

Asbestos Hazard Abatement Plan; G

Testing Laboratory; G

Landfill Approval; G

Delivery Tickets; G

Waste Shipment Records; G

Transporter Certification; G

Medical Certification; G

Private Qualified Person Documentation; G

Designated Competent Person; G

Worker's License; G

Contractor's License; G

Federal, State or Local Citations on Previous Projects; G

Encapsulants; G

Equipment Used to Contain Airborne Asbestos Fibers; G

Water Filtration Equipment; G

Vacuums; G

Ventilation Systems; G

#### SD-11 Closeout Submittals

Permits[ and Licenses]; G

Notifications; G

Respirator Program Records; G

Protective Clothing Decontamination Quality Control Records; G

Protective Clothing Decontamination Facility Notification; G

Rental Equipment; G

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Private Qualified Person Documentation

Submit the name, address, and telephone number of the Private Qualified Person (PQP) selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as, a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer as described by 40 CFR 763 and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The PQP must be appropriately licensed in the State of Georgia as a Project Monitor. The PQP and the asbestos contractor must not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP must be a first tier subcontractor.

#### 1.5.2 Designated Competent Person Documentation

The Designated Competent Person must be experienced in the administration and supervision of asbestos abatement projects including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite. The Designated Competent Person must be on-site at all times when asbestos abatement activities are underway. Submit training certification and a current State of Georgia Asbestos Contractor's and Supervisor's License. Submit evidence that the Designated Competent Person has a minimum of [2] years of on-the-job asbestos abatement experience relevant to OSHA designated competent person requirements. The Designated Competent Person must be a first tier subcontractor.

#### 1.5.3 Worker's License

Submit documentation that workers meet the requirements of 29 CFR 1926.1101, 40 CFR 61-SUBPART M and have a current State of Georgia Asbestos Workers License.

#### 1.5.4 Contractor's License

Submit a copy of the asbestos contractor's license issued by the State of Georgia. Submit the following certification along with the license: "I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61-SUBPART MEM 385-1-1, and the Federal, State and local requirements for those asbestos abatement activities that they will be involved in." This certification statement must be signed by the Company's President or Chief Executive.

#### 1.5.5 Air Sampling Results

Complete fiber counting and provide results to the PQP and GC for review within 16 hours of the "time off" of the sample pump. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer and the affected Contractor employees where required by law within three working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the PQP and GC. Notify the Contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance must levels exceed 0.1 fibers per cubic centimeter.

#### 1.5.6 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.02 inches of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the asbestos control area is removed. Submit pressure differential recordings for each work day to the PQP and GC for review and to the Contracting Officer within 24-hours from the end of each work day.

#### 1.5.7 Protective Clothing Decontamination Quality Control Records

Provide all records that document quality control for the decontamination of reusable outer protective clothing.

#### 1.5.8 Protective Clothing Decontamination Facility Notification

Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

#### 1.5.9 Federal, State or Local Citations on Previous Projects

Submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities within the last 5 years (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company must be provided.

#### 1.5.10 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the Asbestos Hazard Abatement Plan, Accident Prevention Plan (APP) including the AHAs required in specification Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The safety preconstruction conference must include the Contractor and their Designated Competent Person, Designated IH and Project Supervisor and the Contracting Officer. Deficiencies in the APP will be discussed. Onsite work must not begin until the APP has been accepted.

### 1.6 SECURITY

A log book must be kept documenting entry into and out of the regulated area. Entry into regulated areas must only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas must be trained, medically evaluated, and wear the required personal protective equipment.

### 1.7 EQUIPMENT

#### 1.7.1 Rental Equipment

Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

## PART 2 PRODUCTS

### 2.1 ENCAPSULANTS

Encapsulants must conform to current USEPA requirements, contain no toxic or hazardous substances as defined in 29 CFR 1926.59, and conform to the following performance requirements.

#### 2.1.1 Removal Encapsulants

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 43 in/lb	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

#### 2.1.2 Bridging Encapsulant

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 43 in/lb	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

#### 2.1.3 Penetrating Encapsulant

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test

<u>Requirement</u>	<u>Test Standard</u>
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Cohesion/Adhesion Test - 50 pounds of force/foot	ASTM E119
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 43 in/lb	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

#### 2.1.4 Lock-down Encapsulant

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E119
Bond Strength: 100 pounds of force/foot	ASTM E736/E736M
(Tests compatibility with cementitious and fibrous fireproofing)	

## 2.2 ENCASUREMENT PRODUCTS

Encasement must consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the Contracting Officer.

## 2.3 DUCT TAPE

Industrial grade duct tape of appropriate widths suitable for bonding sheet

plastic and disposal container.

#### 2.4 DISPOSAL CONTAINERS

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers must be provided for ACM wastes as required by [29 CFR 1926.1101](#). Disposal containers can be in the form of:

- a. Disposal Bags
- b. Fiberboard Drums
- c. Cardboard Boxes

#### 2.5 SHEET PLASTIC

Sheet plastic must be polyethylene of [6 mil](#) minimum thickness and must be provided in the largest sheet size necessary to minimize seams. Film must be clear and conform to [ASTM D4397](#), except as specified below

##### 2.5.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets must be provided. Film must be frosted or black and must conform to the requirements of [NFPA 701](#).

##### 2.5.2 Reinforced

Reinforced sheets must be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock must consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film must meet flame resistant standards of [NFPA 701](#).

#### 2.6 MASTIC REMOVING SOLVENT

Mastic removing solvent must be nonflammable and must not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite must have a flash point greater than [140 degrees F](#).

#### 2.7 LEAK-TIGHT WRAPPING

Two layers of [6 mil](#) minimum thick polyethylene sheet stock must be used for the containment of removed asbestos-containing components or materials such as large tanks, boilers, insulated pipe segments and other materials. Upon placement of the ACM component or material, each layer must be individually leak-tight sealed with duct tape.

#### 2.8 VIEWING INSPECTION WINDOW

Where feasible, a minimum of one clear, [1/8 inch](#) thick, acrylic sheet, [18 by 24 inches](#), must be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows must be sealed leak-tight with industrial grade duct tape.

#### 2.9 WETTING AGENTS

Removal encapsulant (a penetrating encapsulant) must be provided when conducting removal abatement activities that require a longer removal time

or are subject to rapid evaporation of amended water. The removal encapsulant must be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS above.

### PART 3 EXECUTION

#### 3.1 EQUIPMENT

Provide the Contracting Officer or the Contracting Officer's Representative, with at least two complete sets of personal protective equipment including decontaminating reusable coveralls as required for entry to and inspection of the asbestos control area. Provide equivalent training to the Contracting Officer or a designated representative as provided to Contractor employees in the use of the required personal protective equipment. Provide manufacturer's certificate of compliance for all equipment used to contain airborne asbestos fibers.

##### 3.1.1 Air Monitoring Equipment

The Contractor's PQP must approve air monitoring equipment. The equipment must include, but must not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.
- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps must also be equipped with an automatic flow control unit which must maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.
- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.
- [ d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands when conducting environmental area sampling using NIOSH NMAM Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).
- ] e. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

##### 3.1.2 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

###### 3.1.2.1 Respirators for Handling Asbestos



Provide personnel engaged in pre-cleaning, cleanup, handling, encapsulation removal and or demolition of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103. Breathing air must comply with CGA G-7.

### 3.1.3 Exterior Whole Body Protection

#### 3.1.3.1 Outer Protective Clothing

Provide personnel exposed to asbestos with disposable "non-breathable," [ or reusable "non-breathable" ] whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but must not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body outer protective clothing must be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.

#### 3.1.3.2 Work Clothing

Provide cloth work clothes for wear under the outer protective clothing and foot coverings and either dispose of or properly decontaminate them as recommended by the PQP after each use.

#### 3.1.3.3 Personal Decontamination Unit

Provide a temporary, negative pressure unit with a separate decontamination locker room and clean locker room with a shower that complies with 29 CFR 1926.51(f)(4)(ii) through (V) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated reusable protective clothing while still wearing respirators at the boundary of the asbestos work area, seal in two impermeable bags, label outer bag as asbestos contaminated waste, and transport for decontamination.

Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Wastewater filters must be installed in series with the first stage pore size 20 microns and the second stage pore size of 5 microns. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste. Keep the floor of the decontamination unit's clean room dry and clean at all times. Proper housekeeping and hygiene requirements must be maintained. Provide soap and towels for showering, washing and drying. Cloth towels provided must be disposed of as ACM waste or must be laundered in accordance with 29 CFR 1926.1101. Physically attach the decontamination units to the asbestos control area. Construct both a personnel decontamination unit and an equipment decontamination unit onto and integral with each asbestos control area.

#### [3.1.3.4 Decontamination of Reusable Outer Protective Clothing

When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial

decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.

]3.1.3.5 Eye Protection

Provide eye protection that complies with ANSI/ISEA Z87.1 when operations present a potential eye injury hazard. Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

3.1.4 Regulated Areas

All Class I, II, and III asbestos work must be conducted within regulated areas. The regulated area must be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

3.1.5 Load-out Unit

Provide a temporary load-out unit that is adjacent and connected to the regulated area[ and ] [access tunnel]. Attach the load-out unit in a leak-tight manner to each regulated area.

3.1.6 Warning Signs and Labels

Provide bilingual warning signs printed in English and Spanish at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to the requirements are acceptable

3.1.6.1 Warning Sign

Provide vertical format conforming to 29 CFR 1926.200, and 29 CFR 1926.1101 minimum 20 by 14 inches displaying the following legend in the lower panel:

<u>Legend</u>	<u>Notation</u>
DANGER	one inch Sans Serif Gothic or Block
ASBESTOS	one inch Sans Serif Gothic or Block

<u>Legend</u>	<u>Notation</u>
MAY CAUSE CANCER	one inch Sans Serif Gothic or Block
CAUSES DAMAGE TO LUNGS	1/4 inch Sans Serif Gothic or Block
AUTHORIZED PERSONNEL ONLY	1/4 inch Sans Serif Gothic or Block
WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA	1/4 inch Sans Serif Gothic or Block

Spacing between lines must be at least equal to the height of the upper of any two lines.

3.1.6.2 Warning Labels

Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST AVOID CREATING DUST

3.1.7 Local Exhaust System

Provide a local exhaust system in the asbestos control area in accordance with ASSP Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the asbestos control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment must conform to ASSP Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.8 Tools

Vacuums must be leak proof to the filter and equipped with HEPA filters. Filters on vacuums must conform to ASSP Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.

Reusable tools must be thoroughly decontaminated prior to being removed from the regulated areas.

### 3.1.9 Rental Equipment

If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

#### [3.1.10 Glovebags

Submit written manufacturers proof that glovebags will not break down under expected temperatures and conditions.

#### ]3.1.11 Single Stage Decontamination Area

A decontamination area (equipment room/area) must be provided for Class I work involving less than 25 feet or 10 square feet of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment. The equipment room or area must be adjacent to the regulated area for the decontamination of employees, material, and their equipment which could be contaminated with asbestos. The area must be covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area.

#### 3.1.12 Decontamination Area Exit Procedures

Ensure that the following procedures are followed:

- a. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.
- b. Employees must remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal or laundering.
- c. Employees must not remove their respirators until showering.
- d. Employees must shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, ensure that employees engaged in Class I asbestos jobs:
  - a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or
  - b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

### 3.2 WORK PROCEDURE

Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, and as specified herein. Use [[wet] [ or ] [if given prior EPA approval, dry] removal procedures] [appropriate encapsulation procedures as listed in the asbestos hazard abatement plan] and techniques. Wear and utilize protective clothing and equipment as specified herein. No eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics is permitted in the asbestos work or control areas.

Personnel of other trades not engaged in the encapsulation, removal and demolition of asbestos containing material must not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel. Seal all roof top penetrations, except plumbing vents, prior to asbestos roofing work. Shut down the building heating, ventilating, and air conditioning system, cap the openings to the system, and provide temporary heating, and ventilation, and air conditioning prior to the commencement of asbestos work. Power to the regulated area must be locked-out and tagged in accordance with 29 CFR 1910.147. Disconnect electrical service when encapsulation or wet removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any water or encapsulant.

All electrical work must be performed by a licensed electrician. Stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. Correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling. Work must resume only upon notification by the Contracting Officer. Corrective actions must be documented. If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

### 3.2.1 Building Ventilation System and Critical Barriers

Building ventilation system supply and return air ducts in a regulated area must be isolated by airtight seals to prevent the spread of contamination throughout the system. The airtight seals must consist of air-tight rigid covers for building ventilation supply and exhaust grills where the ventilation system is required to remain in service during abatement. Edges to wall, ceiling and floor surfaces must be sealed with industrial grade duct tape.

- a. A Competent Person must supervise the work.
- b. For indoor work, critical barriers must be placed over all openings to the regulated area.
- c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

### 3.2.2 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it must be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the PQP work may proceed at the discretion of the Contracting Officer.

### 3.2.3 Furnishings

[ Furniture and equipment will remain in the building. Cover and seal furnishings with 6-mil plastic sheet or remove from the work area and store in a location on site approved by the Contracting Officer.

]

#### 3.2.4 Precleaning

Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.

#### 3.2.5 Asbestos Control Area Requirements

##### 3.2.5.1 Negative Pressure Enclosure

Removal of asbestos contaminated acoustical ceiling tiles, spray applied fireproofing, thermal system insulation, gypsum wallboard/joint compound require the use of a negative pressure enclosure. Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Negative pressure enclosure development must include protective covering of uncontaminated walls, and ceilings with a continuous membrane of two layers of minimum 6-mil plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 6-mil plastic sheet over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Provide local exhaust system in the asbestos control area. Openings will be allowed in enclosures of asbestos control areas for personnel and equipment entry and exit, the supply and exhaust of air for the local exhaust system and the removal of properly containerized asbestos containing materials. Replace local exhaust system filters as required to maintain the efficiency of the system.

##### 3.2.5.2 Glovebag

If the construction of a negative pressure enclosure is infeasible for the removal or encapsulation. Use alternate techniques as indicated in 29 CFR 1926.1101. Establish designated limits for the asbestos regulated area with the use of rope or other continuous barriers, and maintain all other requirements for asbestos control areas. The PQP must conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds background or 0.01 fibers per cubic centimeter whichever is greater, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those obtained by the Contractor, the Government will determine which results predominate. If adjacent areas are contaminated as determined by the Contracting Officer, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

##### 3.2.5.3 Regulated Area for Class II Removal

Removal of asbestos containing floor tile/mastic, carpet/mastic and sealants are Class II removal activities. Establish designated limits for the asbestos regulated work area with the use of red barrier tape; install critical barriers, splash guards and signs, and maintain all other requirements for asbestos control area except local exhaust. Place impermeable dropcloths on surfaces beneath removal activity extending out 3 feet in all directions. A detached decontamination system may be used. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If workers the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

### 3.2.6 Removal Procedures

Wet asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation, wrap the pipes and insulation in plastic and remove the pipe by sections. Containerize asbestos containing material while wet. Do not allow asbestos material to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

#### 3.2.6.1 Sealing Contaminated Items Designated for Disposal

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lock-down encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lock-down encapsulant must be tinted a contrasting color and spray-applied by airless method. Thoroughness of sealing operation must be visually gauged by the extent of colored coating on exposed surfaces. Lock-down encapsulants must comply with the performance requirements specified herein.

#### 3.2.6.2 Exposed Pipe Insulation Edges

Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4 inch thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by at least 4 inches. When insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Contracting Officer.

### 3.2.7 Methods of Compliance

#### 3.2.7.1 Mandated Practices

The specific abatement techniques and items identified must be detailed in the Contractor's AHAP. Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters.
- b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal.
- d. Inspection and repair of polyethylene.
- e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

#### 3.2.7.2 Control Methods

Use the following control methods:

- a. Local exhaust ventilation equipped with HEPA filter;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and must supplement them by the use of respiratory protection.

#### 3.2.7.3 Unacceptable Practices

The following work practices must not be used:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean up.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

#### 3.2.8 Class I Work Procedures

In addition to requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

- a. A Competent Person must supervise the installation and operation of the control methods.
- b. For jobs involving the removal of more than 25 feet or 10 square feet of TSI or surfacing material, place critical barriers over all openings



to the regulated area.

- c. HVAC systems must be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.
- d. Impermeable dropcloths (6 mil or greater thickness) must be placed on surfaces beneath all removal activity.
- e. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area must be ventilated with a HEPA unit and employees must use PPE.

### 3.2.9 Specific Control Methods for Class I Work

Use Class I work procedures, control methods and removal methods for the following ACM:

- a. Spray Applied Fireproofing
- b. Gypsum Wallboard and Joint Compound
- c. Thermal System Insulation and Mudded Pipe Fittings
- d. Plaster and Textured Ceilings and Walls
- e. Vermiculite

#### 3.2.9.1 Negative Pressure Enclosure (NPE) System

The system must provide at least four air changes per hour inside the containment. The local exhaust unit equipment must be operated 24-hours per day until the containment is removed. The NPE must be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential must be monitored continuously, 24-hours per day, with an automatic manometric recording instrument and Records must be provided daily on the same day collected to the Contracting Officer. The Contracting Officer must be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system must not be used as the local exhaust system for the regulated area. The NPE must terminate outdoors unless an alternate arrangement is allowed by the Contracting Officer. All filters used must be new at the beginning of the project and must be periodically changed as necessary and disposed of as ACM waste.

#### 3.2.9.2 Glovebag Systems

Glovebags must be used without modification, smoke-tested for leaks, and completely cover the circumference of pipe or other structures where the work is to be done. Glovebags must be used only once and must not be moved. Glovebags must not be used on surfaces that have temperatures exceeding 150 degrees F. Prior to disposal, glovebags must be collapsed using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation must be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least two persons must perform glovebag removal. Asbestos regulated work areas must be established for glovebag abatement. Designated boundary limits for the asbestos work must be established with rope or other continuous barriers and all other requirements for asbestos control areas must be maintained,

including area signage and boundary warning tape.

- a. Attach HEPA vacuum systems to the bag to prevent collapse during removal of ACM.
- b. The negative pressure glove boxes must be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure must be created in the system using a HEPA filtration system. The box must be smoke tested for leaks prior to each use.

#### 3.2.9.3 Mini-Enclosure

Single bulkhead containment, Double bulkhead containment or Mini-containment (small walk-in enclosure) to accommodate no more than two persons, may be used if the disturbance or removal can be completely contained by the enclosure. The mini-enclosure must be inspected for leaks and smoke tested before each use. Air movement must be directed away from the employee's breathing zone within the mini-enclosure.

#### 3.2.9.4 Wrap and Cut Operation

Prior to cutting pipe, the asbestos-containing insulation must be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps must be taken: install glovebag, strip back sections to be cut **6 inches** from point of cut, and cut pipe into manageable sections.

#### 3.2.9.5 Class I Removal Method

Class I ACM must be removed using a control method described above. Prepare work area as previously specified. Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area. Spread one layer of **6-mil** seamless plastic sheeting on the floor below the work area. Remove asbestos containing spray applied fireproofing using a scraper and wet methods and immediately place into **6-mil** thickness disposal bag. After removal of the material use a wire brush to clean the exposed substrate to remove residual material. Continue wet cleaning until surfaces are free of visible debris. Cut manageable sections of gypsum wallboard and joint compound and immediately place into a **6-mil** minimum thickness disposal bag or other approved container. Make every effort to keep the material from falling to the floor of the work area. Use a wire brush and wet clean to remove residual material from studs. Continue wet cleaning until the surface is clean of visible material and encapsulate stud walls. Remove ACM thermal system insulation and mudded pipe fittings using mechanical means and wet methods and immediately place into **6-mil** thickness disposal bag. Continue wet cleaning until surfaces are free of visible debris. Remove ACM plaster ceilings or walls using mechanical means and adequately wet methods and immediately place into **6-mil** thickness disposal bag. Make every effort to keep the material from falling to the floor of the work area. Continue wet cleaning until surfaces are free of visible debris. Remove ACM textured ceiling finish using a scraper and wet methods and immediately place into **6-mil** thickness disposal bag. Floors are considered contaminated from fallen textured ceiling finish. Clean up debris on floor and dispose of carpet as asbestos contaminated material. After removal of the material use a wire brush to clean the exposed concrete to remove residual material. Continue wet cleaning until surfaces

are free of visible debris. Remove ACM vermiculite using mechanical means and adequately wet methods and immediately place into 6-mil thickness disposal bag. Make every effort to keep the material from falling to the floor of the work area. Continue wet cleaning until surfaces are free of visible debris. Bag all asbestos debris which has fallen to the floor as asbestos-containing debris. Place all debris in plastic disposal bags of 6-mil minimum thickness. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or the designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work, and immediately correct the situation.

### 3.2.10 Class II Work Procedures

In addition to the requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

- a. A Competent Person must supervise the work.
- b. For indoor work, critical barriers must be placed over all openings to the regulated area.
- c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

### 3.2.11 Specific Control Methods for Class II Work

#### 3.2.11.1 [Vinyl and Asphaltic Flooring Materials] [Carpet and Mastic]

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. When removing vinyl floor tile and mastic or carpet and mastic which contains ACM, use the following practices. Remove floor tile and mastic or carpet and mastic using adequately wet methods. Remove floor tiles or carpet and mastic intact (if possible). Wetting is not required when floor tiles are heated and removed intact. Do not sand flooring or its backing. Scrape residual adhesive and backing using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos

containing materials as indicated in [40 CFR 61-SUBPART M](#). Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If workers the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

#### 3.2.11.2 Sealants and Mastic

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers and signs, and maintain all other requirements for asbestos control area except local exhaust. Spread [6-mil](#) plastic sheeting on the ground around the perimeter of the work area extending out in all directions. Using adequately wet methods, carefully remove the ACM sealants and mastics using a scraper or knife blade. As it is removed place the material into a disposal bag. Make every effort to keep the asbestos material from falling to the ground or work area floor below. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter and disposable dust bag. Place debris into a [6-mil](#) minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second [6-mil](#) minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in [40 CFR 61-SUBPART M](#). Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or at designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

#### 3.2.11.3 Suspect Fire Doors

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. Spread [6-mil](#) plastic sheeting on the ground beneath the work area and around the perimeter of the work area extending out in all directions. Remove door intact from hinges and wrap with [6-mil](#) plastic sheeting. Inspect the interior areas of the door to determine if ACM is present. If ACM is not present the door may be disposed of as general construction debris. If ACM is present place whole door in enclosed container for disposal. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

#### 3.2.11.4 Roofing Materials

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing roofing materials which contain ACM as described in [29 CFR 1926.1101](#)

(g)(8)(ii), use the following practices. Roofing material must be removed in an intact state. Wet methods must be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards. When removing built-up roofs, with asbestos-containing roofing felts and an aggregate surface, using a power roof cutter, all dust resulting from the cutting operations must be collected by a HEPA dust collector, or must be HEPA vacuumed by vacuuming along the cut line. Asbestos-containing roofing material must not be dropped or thrown to the ground, but must be lowered to the ground via covered, dust-tight chute, crane, hoist or other method approved by the Contracting Officer. Any ACM that is not intact must be lowered to the ground as soon as practicable, but not later than the end of the work shift. While the material remains on the roof it must be kept wet or placed in an impermeable waste bag or wrapped in plastic sheeting. Intact ACM must be lowered to the ground as soon as practicable, but not later than the end of the work shift. Unwrapped material must be transferred to a closed receptacle. Critical barriers must be placed over roof level heating and ventilation air intakes. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

#### 3.2.11.5 Cementitious Siding and Shingles or Transite Panels

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing cementitious asbestos-containing siding, shingles or Transite panels use the following work practices. Intentionally cutting, abrading or breaking is prohibited. Each panel or shingle must be sprayed with amended water prior to removal. Nails must be cut with flat, sharp instruments. Unwrapped or unbagged panels or shingles must be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

#### 3.2.11.6 Gaskets

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Gaskets must be thoroughly wetted with amended water prior to removal and immediately placed in a disposal container. If a gasket is visibly deteriorated and unlikely to be removed intact, removal must be undertaken within a

glovebag. Any scraping to remove residue must be performed wet. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

### [3.2.12 Encapsulation Procedures

#### 3.2.12.1 Preparation of Test Patches

Install three test patches of encapsulant. Use airless spray at the lowest pressure and as recommended by the encapsulant manufacturer. Follow exactly the manufacturer's instructions for thinning recommendations, application procedures and rates. Curing time must be not less than five days or that recommended by the manufacturer, whichever is more. A test patch must be 9 square feet in size.

#### 3.2.12.2 Field Testing

Field test the encapsulation test patches in accordance with ASTM E1494, paragraph "Required Field Test," in the presence of the Contracting Officer.

Keep a written record of the testing procedures and test results. Upon successful testing of the encapsulant, submit a signed statement to the Contracting Officer certifying that the encapsulant is suitable for installation on the particular asbestos containing material.

#### 3.2.12.3 Large-Scale Application

Apply encapsulant using the same equipment and procedures as employed for the test patches. Keep the encapsulant material stirred to prevent settling. Keep a clean work area. Change pre-filters in the ventilation equipment as soon as they appear clogged by encapsulant aerosol or pressure differential drops below 0.02 Hg.

### ]3.2.13 Abatement of Asbestos Contaminated Soil

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Asbestos contaminated soil must be removed from areas to a minimum depth of 2 inches. Soil must be thoroughly dampened with amended water and then removed by manual shoveling into labeled containers. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated

limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

#### 3.2.14 Air Sampling

Perform sampling of airborne concentrations of asbestos fibers in accordance with 29 CFR 1926.1101, the Contractor's air monitoring plan and as specified herein. Sampling performed in accordance with 29 CFR 1926.1101 must be performed by the PQP. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate. Results of breathing zone samples must be posted at the job site and made available to the Contracting Officer. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

##### 3.2.14.1 Sampling Prior to Asbestos Work

Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each demolition, removal or encapsulation site. Establish the background by performing area sampling in similar but uncontaminated sites in the building.

##### 3.2.14.2 Sampling During Asbestos Work

The PQP must provide personal and area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. In addition, provided the same type of work is being performed, provide area sampling at least once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. The written results must be signed by testing laboratory analyst, testing laboratory principal and the Contractor's PQP. The air sampling results must be documented on a Contractor's daily air monitoring log.

##### 3.2.14.3 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH NMAM Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, must be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) must be confirmed from that same filter using NIOSH NMAM Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning must be repeated at the Contractor's expense. Upon completion of any required recleaning, resampling with

results to meet the above clearance criteria must be done at the Contractor's expense.

#### 3.2.14.4 Final Clearance Requirements, EPA TEM Method

For EPA TEM sampling and analysis, using the EPA Method specified in [40 CFR 763](#), abatement inside the regulated area is considered complete when the arithmetic mean asbestos concentration of the five inside samples is less than or equal to 70 structures per square millimeter (70 S/mm). When the arithmetic mean is greater than 70 S/mm, the three blank samples must be analyzed. If the three blank samples are greater than 70 S/mm, resampling must be done. If less than 70 S/mm, the five outside samples must be analyzed and a Z-test analysis performed. When the Z-test results are less than 1.65, the decontamination must be considered complete. If the Z-test results are more than 1.65, the abatement is incomplete and cleaning must be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria must be done at the Contractor's expense.

#### 3.2.14.5 Sampling After Final Clean-Up ([Clearance Sampling](#))

Provide area sampling of asbestos fibers and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the enclosure or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the PQP must perform a visual inspection in accordance with [ASTM E1368](#) to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. Prepare a written report signed and dated by the PQP documenting that the asbestos control area is free of dust, dirt, and debris and all waste has been removed. Use transmission electron microscopy (TEM) to analyze clearance samples and report the results in accordance with current NIOSH criteria. The asbestos fiber counts from these samples must be less than 0.01 fibers per cubic centimeter or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value take appropriate actions to re-clean the area and repeat the sampling and [TEM] analysis at the Contractor's expense.

#### 3.2.14.6 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

#### 3.2.15 Lock-Down

Prior to removal of plastic barriers and after pre-clearance clean up of gross contamination, the PQP must conduct a visual inspection of all areas affected by the removal or encapsulation in accordance with [ASTM E1368](#). Inspect for any visible fibers, and to ensure that encapsulants were applied evenly and appropriately. Spray apply a post removal (lock-down) encapsulant to ceiling, walls, floors and other areas exposed in the removal area. The exposed area includes but is not limited to plastic barriers, furnishings and articles to be discarded as well as dirty change room, air locks for bag removal and decontamination chambers.

#### 3.2.16 Site Inspection

While performing asbestos engineering control work, the Contractor must be



subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation must be at the Contractor's expense.

### 3.3 CLEAN-UP AND DISPOSAL

#### 3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the enclosure removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor must re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry will be permitted. The Government must have the option to perform monitoring to determine if the areas are safe before entry is permitted.

#### 3.3.2 Title to Materials

All waste materials, except as specified otherwise, become the property of the Contractor and must be disposed of as specified in applicable local, State, and Federal regulations and herein.

#### 3.3.3 Disposal of Asbestos

##### 3.3.3.1 Procedure for Disposal

Coordinate all waste disposal manifests with the Contracting Officer and NAVFAC EV. Collect asbestos waste, contaminated waste water filters, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag. Clearly indicate on the outside of each container the name of the waste generator and the location at which the waste was generated. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining

the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Comply with 40 CFR 61-SUBPART M, State, regional, and local standards for hauling and disposal. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags must remain in the drum and the entire contaminated drum must be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums must wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

#### 3.3.3.2 Asbestos Disposal Quantity Report

Direct the PQP to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as described initially in this specification and in cubic feet for the amount of asbestos containing material released for disposal.

Allow the GC to inspect, record and report the amount of asbestos containing material removed and released for disposal on a daily basis.

-- End of Section --

## SECTION 02 83 00

## LEAD REMEDIATION

11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2 (2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

## ASTM INTERNATIONAL (ASTM)

ASTM E1613 (2012) Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques

ASTM E1644 (2021) Standard Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead

ASTM E1726 (2021) Standard Practice for Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis

ASTM E1727 (2016) Standard Practice for Field Collection of Soil Samples for Subsequent Lead Determination

ASTM E1728/E1728M (2020) Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2019) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual

## U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 - 1997)

Guidelines for the Evaluation and Control  
of Lead-Based Paint Hazards in Housing

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.21	Safety Training and Education
29 CFR 1926.33	Access to Employee Exposure and Medical Records
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.103	Respiratory Protection
29 CFR 1926.1126	Chromium
29 CFR 1926.1127	Cadmium
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

## U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

ND OPNAVINST 5100.23	(2005; Rev G) Navy Occupational Safety and
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## Health (NAVOSH) Program Manual

## UNDERWRITERS LABORATORIES (UL)

UL 586

(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

## 1.2 DEFINITIONS

## 1.2.1 Abatement

Measures defined in 40 CFR 745, Section 223, designed to permanently eliminate lead-based paint hazards.

## 1.2.2 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of chromium (VI) of 2.5 micrograms per cubic meter of air averaged over an 8-hour period.

## 1.2.3 Area Sampling

Sampling of lead, cadmium, chromium concentrations within the lead, cadmium, chromium control area and inside the physical boundaries which is representative of the airborne lead, cadmium, chromium concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

## 1.2.4 Cadmium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1127. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 40/\text{No. hrs worked per day}$$

## 1.2.5 Certified Industrial Hygienist (CIH)

As used in this section refers to a person retained by the Contractor who is certified as an industrial hygienist and who is trained in the recognition and control of lead, cadmium and chromium hazards in accordance with current federal, State, and local regulations. CIH must be certified for comprehensive practice by the American Board of Industrial Hygiene. The Certified Industrial Hygienist must be independent of the Contractor and must have no employee or employer relationship which could constitute a conflict of interest.

## 1.2.6 Child-Occupied Facility

Real property which is a building or portion of a building constructed prior to 1978 visited regularly by the same child, six-years of age or under, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3-hours, and the combined annual visits last at least 60-hours. Child-occupied facilities include but are not limited to, day-care centers, preschools and

kindergarten classrooms.

#### 1.2.7 Chromium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1126. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 40/\text{No. hrs worked per day}$$

#### 1.2.8 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead, cadmium and chromium hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead, cadmium and chromium hazard. The Contractor may provide more than one CP as required to supervise and monitor the work. The CP must be a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals or a licensed lead-based paint abatement Supervisor/Project Designer in the State of Georgia.

#### 1.2.9 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

#### 1.2.10 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

#### 1.2.11 Deleading

Activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or paints containing cadmium/chromium or to plan such activities in commercial buildings, bridges or other structures.

#### 1.2.12 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead, cadmium, chromium to which an employee is exposed, averaged over an 8-hour workday as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

#### 1.2.13 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead, cadmium, chromium contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

#### 1.2.14 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds. The use of the term Lead in this section also refers to paints which contain detectable concentrations of Cadmium and Chromium. For the purposes of the section lead-based paint

(LBP) and paint with lead (PWL) also contains cadmium and chromium.

#### 1.2.15 Lead-Based Paint (LBP)

Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.

#### 1.2.16 Lead-Based Paint Activities

In the case of target housing or child occupied facilities, lead-based paint activities include; a lead-based paint inspection, a risk assessment, or abatement of lead-based paint hazards.

#### 1.2.17 Lead-Based Paint Hazards

Paint-lead hazard, dust-lead hazard or soil-lead hazard as identified in 40 CFR 745, Section 65. Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.

#### 1.2.18 Lead, Cadmium, Chromium Control Area

A system of control methods to prevent the spread of lead, cadmium, chromium dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

#### 1.2.19 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

#### 1.2.20 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

#### 1.2.21 Personal Sampling

Sampling of airborne lead, cadmium, chromium concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Samples must be representative of the employees' work tasks. Breathing zone must be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

#### 1.2.22 Physical Boundary

Area physically roped or partitioned off around lead, cadmium, chromium control area to limit unauthorized entry of personnel.

#### 1.2.23 Target Housing

Residential real property which is housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any one or more children age 6-years or under resides or is expected to reside in such housing for the elderly or persons with disabilities) or any zero bedroom dwelling.

### 1.3 DESCRIPTION

Construction activities impacting PWL or material containing lead, cadmium, chromium which are covered by this specification include the demolition or removal of material containing lead, cadmium, chromium. The work covered by this section includes work tasks and the precautions specified in this section for the protection of building occupants and the environment during and after the performance of the hazard abatement activities.

#### 1.3.1 Protection of Existing Areas To Remain

Project work including, but not limited to, lead, cadmium, chromium hazard abatement work, storage, transportation, and disposal must be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, restore work and areas to the original condition.

#### 1.3.2 Coordination with Other Work

Coordinate with work being performed in adjacent areas to ensure there are no exposure issues. Explain coordination procedures in the Lead, Cadmium, Chromium Compliance Plan and describe how the Contractor will prevent lead, cadmium and chromium exposure to other contractors and Government personnel performing work unrelated to lead, cadmium and chromium activities.

#### 1.3.3 Sampling and Analysis

Submit a log of the analytical results from sampling conducted during the abatement. Keep the log of results current with project activities and brief the results to the Contracting Officer as analytical results are reported.

##### 1.3.3.1 Dust Wipe Materials, Sampling and Analysis

Sampling must conform to ASTM E1728/E1728M. Analysis must conform to ASTM E1613 and ASTM E1644.

##### 1.3.3.2 Soil Sampling and Analysis

Sampling must conform to ASTM E1727. Analysis must conform to ASTM E1613 and ASTM E1726.

##### 1.3.3.3 Clearance Monitoring

- a. Collect dust wipe samples inside the lead, cadmium and chromium hazard control area after the final visual inspection in the quantities and at the locations specified.



- (1) Floors .
- (2) Interior Window Sills.
- (3) Window Troughs.

b. Collect exterior bare soil samples inside the lead, cadmium and chromium hazard control area after the final visual inspection in the quantities and at the locations specified.

- (1) Near the building foundation.
- (2) Nearby Play areas.

#### 1.3.4 Clearance Requirements

Target housing and child occupied facilities clearance levels.

- (1) Floors.
- (2) Interior Window Sills.
- (3) Window Troughs.
- (4) Bare soils in play areas accessible by children.
- (5) Bare soils in all other areas.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

Competent Person Qualifications; G

Training Certification; G

Occupational and Environmental Assessment Data Report; G

Medical Examinations; G

Lead, Cadmium, Chromium Waste Management Plan; G

Licenses, Permits and Notifications; G

Occupant Protection Plan; G

Lead, Cadmium, Chromium Compliance Plan; G

Initial Sample Results; G

Written Evidence of TSD Approval; G

##### SD-03 Product Data

Respirators; G

Vacuum Filters; G

Negative Air Pressure System; G

Materials and Equipment; G

Expendable Supplies; G

Local Exhaust Equipment; G

Pressure Differential Automatic Recording Instrument; G

Pressure Differential Log; G

#### SD-06 Test Reports

Sampling and Analysis; G

Occupational and Environmental Assessment Data Report; G

Sampling Results; G

Pressure Differential Recordings For Local Exhaust System; G

#### SD-07 Certificates

Testing Laboratory; G

Third Party Consultant Qualifications; G

Occupant Notification; G

Notification of the Commencement of LBP Hazard Abatement; G

Clearance Certification; G

#### SD-11 Closeout Submittals

Hazardous Waste Manifest; G

Turn-In Documents or Weight Tickets; G

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Qualifications

##### 1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph COMPETENT PERSON (CP) RESPONSIBILITIES. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), Cadmium standard (29 CFR 1926.1127) which shows ability to assess occupational and environmental exposure to lead, cadmium, chromium; experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Demonstrate a minimum of 3 years experience implementing OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), and Cadmium standard (29 CFR 1926.1127). Submit proper documentation that the CP is trained in accordance with federal, State Georgia and local laws..

##### 1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead, cadmium and chromium training specified in 40 CFR 745 and is certified to perform or supervise deleading, lead removal or demolition activities in the State of Georgia.

#### 1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air, soil, and wipe analysis, testing, and reporting of airborne concentrations of lead, cadmium and chromium. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis must be OSHA approved.

#### 1.5.1.4 Third Party Consultant Qualifications

Submit the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead, cadmium and chromium in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

#### 1.5.1.5 Certified Risk Assessor

The Certified Risk Assessor must be certified pursuant to 40 CFR 745, Section 226 and be responsible to perform the clearance sampling, clearance sample data evaluation and summarize clearance sampling results in a section of the abatement report. The risk assessor must sign the abatement report to indicate clearance requirements for the contract have been met.

### 1.5.2 Requirements

#### 1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead, Cadmium, Chromium Compliance Plan for conformance to the applicable referenced standards.
- c. Continuously inspect LBP/PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

- g. Supervise final cleaning of the lead, cadmium, chromium control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.
- h. Certify the conditions of the work as called for elsewhere in this specification.
- i. The CP must be certified pursuant to 40 CFR 745, Section 226 and is responsible for development and implementation of the occupant protection plan, the abatement report and supervise lead, cadmium and chromium hazard abatement work activities.

#### 1.5.2.2 Lead, Cadmium, Chromium Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of lead, cadmium and chromium, LBP/PWL or MCL. Include in the plan a sketch showing the location, size, and details of lead, cadmium, chromium control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead, cadmium, chromium is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead, cadmium, chromium related work, collected waste water and dust containing lead, cadmium, chromium and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead, cadmium, chromium is not released outside of the lead, cadmium, chromium control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

The plan must be developed and signed by a certified Lead Project Designer in the State of Georgia. The plan must include the name and certification number of the person signing the plan.

In occupied buildings, the plan must also include an occupant protection program that describes the measures that will be taken during the work to notify and protect the building occupants.

#### 1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 the Contractor must provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and supporting the Lead, Cadmium, Chromium Compliance Plan.

- a. The initial monitoring must represent each job classification, or if working conditions are similar to previous jobs by the same employer,

provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. The data must represent the worker's regular daily exposure to lead, cadmium, chromium for stated work.

- b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead, cadmium and chromium containing coatings are present.
- c. The initial assessment must determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead, cadmium, chromium compliance plan per 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

#### 1.5.2.4 Medical Examinations

Submit pre-work blood lead levels and post-work blood lead levels for all workers performing lead, cadmium, chromium activities during the execution of the work. Initial medical surveillance as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 must be made available to all employees exposed to lead, cadmium, chromium at any time (one day) above the action level. Full medical surveillance must be made available to all employees on an annual basis who are or may be exposed to lead, cadmium and chromium in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Adequate records must show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead, cadmium, chromium as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

#### 1.5.2.5 Training

Train each employee performing work that disturbs lead, cadmium, chromium, who performs LBP/MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, 40 CFR 745 and State Georgia and local regulations where appropriate.

#### 1.5.2.6 Respiratory Protection Program

- a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.
- b. Establish and implement a respiratory protection program as required by 29 CFR 1926.103, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.55.

#### 1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

#### 1.5.2.8 Lead, Cadmium, Chromium Waste Management

The [Lead, Cadmium, Chromium Waste Management Plan](#) must comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of USEPA .
- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with [29 CFR 1926.65](#).
- g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Clean up and containerize wastes daily.
- h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.
- i. Unit cost for hazardous waste disposal according to this plan.

#### 1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead, cadmium and chromium. Comply with the applicable requirements of the current issue of [29 CFR 1926.62](#), [29 CFR 1926.1126](#), [29 CFR 1926.1127](#), [EM 385-1-1](#), [ND OPNAVINST 5100.23](#). Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirements apply.

Licensing and certification in the state of [Georgia](#) is required.

#### 1.5.3 [Pressure Differential Recordings for Local Exhaust System](#)

Provide a local exhaust system that creates a negative pressure of at least [0.02 inches](#) of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the lead, cadmium, chromium control area is removed. Submit pressure differential recordings for each work day to the PQP for review and to the Contracting Officer within 24-hours from the end of each work day.

#### 1.5.4 [Licenses, Permits and Notifications](#)

Certify and submit in writing to the Regional Office of the EPA state's environmental protection agency responsible for lead hazard abatement activities and the Contracting Officer at least 10 days prior to the commencement of work that required licenses, permits and notifications have been obtained. All associated fees or costs incurred in obtaining the licenses, permits and notifications are included in the contract price.

#### 1.5.5 Occupant Protection Plan

The certified project designer must develop and implement an Occupant Protection Plan describing the measures and management procedures to be taken during lead, cadmium and chromium hazard abatement activities to protect the building occupants/building facilities and the outside environment from exposure to any lead, cadmium and chromium contamination while lead, cadmium and chromium hazard abatement activities are performed.

#### 1.5.6 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead, Cadmium, Chromium Waste Management Plan and the Lead, Cadmium, Chromium Compliance Plan, including procedures and precautions for the work.

### 1.6 EQUIPMENT

#### 1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead, cadmium and chromium dust, fume and mist. Respirators must comply with the requirements of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

#### 1.6.2 Special Protective Clothing

Personnel exposed to lead, cadmium, chromiumcontaminated dust must wear proper disposable or uncontaminated, reusable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

#### 1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

#### 1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

#### 1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead, cadmium and chromium removal work within the lead, cadmium and chromium controlled area. Personal protective equipment must include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE remains the property of the Contractor.

The Government will provide respiratory protection for the Contracting Officer.

#### 1.6.6 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

#### 1.6.7 Negative Air Pressure System

##### 1.6.7.1 Minimum Requirements

Do not proceed with work in the area until containment is set up and HEPA filtration systems are in place. The negative air pressure system must meet the requirements of [ASSP Z9.2](#) including approved HEPA filters in accordance with [UL 586](#). Negative air pressure equipment must be equipped with new HEPA filters, and be sufficient to maintain a minimum pressure differential of minus [0.02 inch of water column](#) relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed as follows:

- a. The unit must be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.
- b. The HEPA filter must be certified as being capable of trapping and retaining mono-disperse particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
- c. The unit must be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures [2.5 inches of water](#) static pressure differential on a magnehelic gauge.
- d. Equip the unit with a manometer-type negative pressure differential monitor with minor scale division of [0.02 inch of water](#) and accuracy within plus or minus 1.0 percent. The manometer must be calibrated daily as recommended by the manufacturer.
- e. Equip the unit with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.
- f. Equip the unit with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.
- g. Equip the unit with an audible horn that sounds an alarm when the machine has shut itself off.
- h. Equip the unit with an automatic safety mechanism that prevents a worker from improperly inserting the main HEPA filter.

##### 1.6.7.2 Auxiliary Generator

Provide an auxiliary generator with capacity to power a minimum of 50 percent of the negative air machines at any time during the work. When power fails, the generator controls must automatically start the generator and switch the negative air pressure system machines to generator power.



The generator must not present a carbon monoxide hazard to workers.

#### 1.6.8 Vacuum Systems

Vacuum systems must be suitably sized for the project, and filters must be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometers (mean aerodynamic diameter) at a minimum efficiency of 99.97 percent. Properly dispose of used filters that are being replaced.

#### 1.6.9 Heat Blower Guns

Heat blower guns must be flameless, electrical, paint-softener type with controls to limit temperature to 1,100 degrees F. Heat blower must be (grounded) 120 volts ac, and must be equipped with cone, fan, glass protector and spoon reflector nozzles.

### 1.7 PROJECT/SITE CONDITIONS

#### 1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

Keep materials and equipment needed to complete the project available and on the site. Submit a description of the materials and equipment required; including Safety Data Sheets (SDSs) for material brought onsite to perform the work.

#### 2.1.1 Expendable Supplies

Submit a description of the expendable supplies required.

##### 2.1.1.1 Polyethylene Bags

Disposable bags must be polyethylene plastic and be a minimum of 6 mils thick (4 mils thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

##### 2.1.1.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead, cadmium, chromium contaminated debris must be polyethylene plastic that is a minimum of 6 mils thick or any other thick plastic material shown to demonstrate at least equivalent performance.

##### 2.1.1.3 Polyethylene Sheeting

Sheeting must be polyethylene plastic with a minimum thickness of 6 mil, or any other thick plastic material shown to demonstrate at least equivalent performance; and be provided in the largest sheet size reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, provide flame-resistant

polyethylene sheets which conform to the requirements of [NFPA 701](#).

#### 2.1.1.4 Tape and Adhesive Spray

Tape and adhesive must be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive must retain adhesion when exposed to wet conditions, including amended water. Tape must be minimum [2 inches](#) wide, industrial strength.

#### 2.1.1.5 Containers

When used, containers must be leak-tight and be labeled in accordance with EPA, DOT and OSHA standards.

#### 2.1.1.6 Chemical Paint Strippers

Chemical paint strippers must not contain methylene chloride and be formulated to prevent stain, discoloration, or raising of the substrate materials.

#### 2.1.1.7 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers must be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

#### 2.1.1.8 Detergents and Cleaners

Detergents or cleaning agents must not contain trisodium phosphate and have demonstrated effectiveness in lead, cadmium and chromium control work using cleaning techniques specified by [HUD 6780](#) guidelines.

### PART 3 EXECUTION

#### 3.1 PREPARATION

##### 3.1.1 Protection

###### 3.1.1.1 Notification

- a. Notify the Contracting Officer 20 days prior to the start of any lead, cadmium and chromium work.

- b. [Occupant Notification](#)

Submit occupant written acknowledgment of the delivery of lead hazard information pamphlet (EPA 747-K-99-001 "Protect Your Family From Lead in Your Home") prior to commencing the renovation work for each affected unit using language provided in [40 CFR 745](#) Subpart E.

- c. [Notification of the Commencement of LBP Hazard Abatement](#)

Submit a copy of the notification of the commencement of LBP hazard abatement to [Air Pollution Control Division](#) according to the procedures established by [Reg. 19](#).

###### 3.1.1.2 Lead, Cadmium, Chromium Control Area

- a. Physical Boundary - Provide physical boundaries around the lead, cadmium, chromium control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead, cadmium and chromium will not escape outside of the lead, cadmium and chromium control area. Prohibit the general public from accessing the lead, cadmium, chromium control areas.
- b. Warning Signs - Provide warning signs at approaches to lead, cadmium, chromium control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs must comply with the requirements of 29 CFR 1926.62.

#### 3.1.1.3 Furnishings

The Government will remove furniture and equipment from the building before lead, cadmium and chromium work begins.

#### 3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead, cadmium, chromium control areas. Seal intake and exhaust vents in the lead, cadmium, chromium control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead, cadmium, chromium control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead, cadmium, chromium control area.

#### 3.1.1.5 Local Exhaust System

Provide a local exhaust system in the lead, cadmium, chromium control area in accordance with ASSP Z9.2, 29 CFR 1926.62, 29 CFR 1926.1126 and 29 CFR 1926.1127 that will provide at least 4 air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the lead, cadmium, chromium control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the lead, cadmium, chromium control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the lead, cadmium, chromium control area. Filters on exhaust equipment must conform to ASSP Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

#### 3.1.1.6 Negative Air Pressure System Containment

- a. Operate the negative air pressure systems to provide at least 4 air changes per hour inside the containment. Operate the local exhaust unit equipment continuously until the containment is removed. Smoke test the negative air pressure system for leaks at the beginning of each shift. The certified supervisor is responsible to continuously monitor and keep a pressure differential log with an automatic manometric recording instrument. Notify the Contracting Officer immediately if the pressure differential falls below the prescribed minimum. Submit the continuously monitored pressure differential log, as specified. Do not use the building ventilation system as the local exhaust system. Terminate the local exhaust system out of doors unless

the Contracting Officer allows an alternate arrangement. All filters must be new at the beginning of the project and be periodically changed as necessary to maintain specified pressure differential and disposed of as lead, cadmium and chromium contaminated waste.

- b. Discontinuing Negative Air Pressure System. Operate the negative air pressure system continuously during abatement activities unless otherwise authorized by the Contracting Officer. At the completion of the project, units must be run until full cleanup has been completed and final clearance testing requirements have been met. Dismantling of the negative air pressure systems must be as presented in the [Lead, Cadmium, Chromium Compliance Plan](#). Seal the HEPA filter machine intakes with polyethylene to prevent environmental contamination.

#### 3.1.1.7 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and [29 CFR 1926.62](#), [29 CFR 1926.1126](#), [29 CFR 1926.1127](#).

#### 3.1.1.8 Eye Wash Station

Provide suitable facilities within the work area for quick drenching or flushing of the eyes where eyes may be exposed to injurious corrosive materials.

#### 3.1.1.9 Mechanical Ventilation System

- a. Use adequate ventilation to control personnel exposure to lead, cadmium and chromium in accordance with [29 CFR 1926.62](#), [29 CFR 1926.1126](#), [29 CFR 1926.1127](#). To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Evaluate and maintain local exhaust ventilation systems in accordance with [29 CFR 1926.62](#), [29 CFR 1926.1126](#), [29 CFR 1926.1127](#).
- b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.
- c. Use locally exhausted, power actuated tools or manual hand tools.

#### 3.1.1.10 Personnel Protection

Personnel must wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead, cadmium, chromium control area. No one will be permitted in the lead, cadmium, chromium control area unless they have been appropriately trained and provided with protective equipment.

### 3.2 ERECTION

#### 3.2.1 Lead, Cadmium, Chromium Control Area Requirements

Establish a lead, cadmium, chromium control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

Full containment - Contain removal operations by the use of a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP. For containment areas larger than

1,000 square feet install a minimum of two 18 inch square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

### 3.3 APPLICATION

#### 3.3.1 Lead, Cadmium, Chromium Work

Perform lead, cadmium, chromium work in accordance with approved Lead, Cadmium, Chromium Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead, cadmium, chromium when the work is performed in accordance with 29 CFR 1926.62, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

#### 3.3.2 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium Removal

Manual or power sanding or grinding of lead, cadmium, chromium surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead, cadmium, chromium is prohibited. Provide methodology for removing lead, cadmium, chromium in the Lead, Cadmium, Chromium Compliance Plan. Select lead, cadmium, chromium removal processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead, cadmium, chromium. Describe this removal process in the Lead, Cadmium, Chromium Compliance Plan.

Avoid flash rusting or deterioration of the substrate. Provide surface preparations for painting in accordance with Section 09 90 00 PAINTS AND COATINGS.

Provide methodology for lead, cadmium and chromium, LBP/PWL removal, abatement/control and processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead, cadmium, chromium. Describe this lead, cadmium and chromium, LBP/PWL removal/control process in the Lead, Cadmium, Chromium Compliance Plan.

##### 3.3.2.1 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium - Indoor Removal

Perform manual, mechanical, removal or thermal cutting in the lead, cadmium, chromium control areas using enclosures, barriers or containments and powered locally exhausted tools equipped with HEPA filters. Collect residue and debris for disposal in accordance with federal, State, and local requirements.

##### 3.3.2.2 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium - Outdoor Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead, Cadmium, Chromium Compliance Plan. The worksite preparation (barriers or containments) must be job dependent and presented in the Lead, Cadmium, Chromium Compliance Plan.

### 3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead, cadmium, chromium controlled area, they must perform the following procedures and must not leave the work place wearing any clothing or equipment worn in the control area:

- a. Vacuum all clothing before entering the contaminated change room.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
- c. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.
- d. Change to clean clothes prior to leaving the clean clothes storage area.

## 3.4 FIELD QUALITY CONTROL

### 3.4.1 Tests

#### 3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead, cadmium, chromium in accordance with [29 CFR 1926.62](#), [29 CFR 1926.1126](#), [29 CFR 1926.1127](#) and as specified herein. Air and wipe sampling must be directed or performed by the CP.

- a. The CP must be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
- b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air samples, signed by the CP, within 72-hours after the air samples are taken.
- d. Conduct area air sampling daily, on each shift in which lead, cadmium and chromium and lead-based paint removal operations are performed, in areas immediately adjacent to the lead, cadmium and chromium control area. Conduct sufficient area monitoring to ensure unprotected personnel are not exposed at or above 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air. If 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Resume removal work only after the CP and the Contracting Officer give approval.
- e. Before any work begins, a third party consultant must collect and analyze baseline wipe and soil samples in accordance with methods defined by federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the

facility prior to lead, cadmium and chromium disturbance or removal. Provide [Initial Sample Results](#) to the Contracting Officer before work begins.

- f. Surface Wipe Samples - Collect surface wipe samples on floors at a location no greater than [10 feet](#) outside the lead, cadmium, chromium control area at a frequency of once per day while lead, cadmium, chromium removal work is conducted in occupied buildings. Surface wipe samples or Micro Vacuum surface sample results must meet criteria in paragraph CLEARANCE CERTIFICATION.

#### 3.4.1.2 Sampling After Removal

After the visual inspection, conduct soil sampling if bare soil is present during external removal operations and collect wipe samples according to the HUD protocol contained in [HUD 6780](#) to determine the lead, cadmium and chromium content of settled dust in micrograms per square meter foot of surface area and [parts per million \(ppm\)](#) for soil.

#### 3.4.1.3 Testing of Material Containing Lead, Cadmium, Chromium Residue

Test residue in accordance with [40 CFR 261](#) for hazardous waste.

### 3.5 CLEANING AND DISPOSAL

#### 3.5.1 Cleanup

Maintain surfaces of the lead, cadmium, chromium control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead, cadmium, chromium operation has been completed, clean the controlled area of all visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead, Cadmium, Chromium Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP must then certify in writing that the area has been cleaned of lead, cadmium and chromium contamination before clearance testing.

##### 3.5.1.1 Clearance Certification

The CP must certify in writing that air samples collected outside the lead, cadmium, chromium control area during paint removal operations are less than 30 micrograms of lead per cubic meter of air and less than 2.5 micrograms of cadmium/chromium per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with [29 CFR 1926.62](#), [29 CFR 1926.1126](#), [29 CFR 1926.1127](#); and that there were no visible accumulations of material and dust containing lead, cadmium, chromium left in the work site. Do not remove the lead, cadmium, chromium control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

The third party consultant must certify surface wipe sample results collected inside and outside the work area are less than 40 micrograms of lead per [square foot](#) on floors, less than 250 micrograms of lead per [square](#)

foot on interior window sills and less than 400 micrograms of lead per square foot on window troughs not significantly greater than the initial surface loading determined prior to work.

The third party consultant must certify surface wipe sample or Micro Vacuum surface sample results collected inside and outside the work area are less than 200 micrograms of lead per square foot on floors or horizontal surfaces. Micro Vacuum technique should be used on rough or porous surfaces which are difficult to achieve clearance by the wipe sampling methodology.

Certify surface wipe samples are not significantly greater than the initial surface loading determined prior to work.

Clear the lead, cadmium, chromium control area in industrial facilities of all visible dust and debris.

For exterior work, soil samples taken at the exterior of the work site must be used to determine if soil lead, cadmium, chromium levels have increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead, cadmium, chromium levels prior to the operation. If soil lead, cadmium, chromium levels either show a statistically significant increase above soil lead, cadmium, chromium levels prior to work or soil lead, cadmium, chromium levels above any applicable federal or state standard for lead, cadmium, chromium in soil, the soil must be remediated.

For lead, cadmium and chromium-based paint hazard abatement work, surface wipe and soil sampling must be conducted and clearance determinations made according to the work practice standards presented in 40 CFR 745.227.

### 3.5.2 Disposal

- a. Dispose of material, whether hazardous or non-hazardous in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
- b. Contractor is responsible for segregation of waste. Collect lead, cadmium, chromium contaminated waste, scrap, debris, bags, containers, equipment, and lead, cadmium, chromium contaminated clothing that may produce airborne concentrations of lead, cadmium, chromium particles. Label the containers in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 40 CFR 261, 40 CFR 262 and corresponding state regulations.
- c. Dispose of lead, cadmium, chromium contaminated material classified as hazardous waste at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Accumulate waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums or appropriately sized container for smaller volumes. Properly label each drum to identify the type of hazardous material (49 CFR 172). For hazardous waste, the collection container requires marking/labeling in accordance with 40 CFR 262 and corresponding state regulations during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for accumulation of waste containers. Coordinate



authorized accumulation volumes and time limits with the host installation environmental function.

- e. Handle, store, transport, and dispose lead, cadmium, chromium or lead, cadmium, chromium contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- f. All lead, cadmium, and chromium waste generation, management, and disposal will be coordinated with the host installation environmental function.

#### 3.5.2.1 Disposal Documentation

Coordinate all disposal or off-site shipments of lead, cadmium, and chromium waste with the host installation environmental function. Submit written evidence of TSD approval to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead, cadmium, chromium disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

#### 3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility is received and approved by the Contracting Officer. The manifest must detail and certify the amount of lead, cadmium, chromium containing materials or non-hazardous waste delivered to the treatment or disposal facility.

-- End of Section --

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## SECTION 02 84 16

HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY  
05/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 273	Standards for Universal Waste Management
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 178	Specifications for Packagings

## 1.2 REQUIREMENTS

Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts.

## 1.3 DEFINITIONS

## 1.3.1 Certified Industrial Hygienist (CIH)

A industrial hygienist hired by the contractor shall be certified by the American Board of Industrial Hygiene.

#### 1.3.2 Leak

Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

#### 1.3.3 Lamps

Lamp is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

#### 1.3.4 Polychlorinated Biphenyls (PCBs)

PCBs as used in this specification shall mean the same as PCBs, and all related items, as defined in 40 CFR 761, Section 3, Definitions.

#### 1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

#### 1.3.6 Universal Waste

Universal Waste means any of the following hazardous wastes that are managed under the universal waste requirements 40 CFR 273:

- (1) Batteries as described in Sec. 273.2 of this chapter;
- (2) Pesticides as described in Sec. 273.3 of this chapter;
- (3) Mercury containing equipment as described in Sec. 273.4 of this chapter; and
- (4) Lamps as described in Sec. 273.5 of this chapter.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Regulatory Requirements

Perform PCB related work in accordance with 40 CFR 761. [ Perform mercury-containing lamps storage and transport in accordance with 40 CFR 261, 40 CFR 264, 40 CFR 265, 40 CFR 273.]

#### 1.4.2 Training

Certified industrial hygienist (CIH) shall instruct and certify the training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps. The instruction shall include: The dangers of PCB and mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA regulations. The CIH shall review and approve

the PCB and Mercury-Containing Lamp Removal Work Plans.

#### 1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, 40 CFR 273 and of the Contractor removal work plan and disposal plan for PCB and for associated mercury-containing lamps.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-07 Certificates

Qualifications of CIH; G

Training Certification; G

PCB and Lamp Removal Work Plan; G

PCB and Lamp Disposal Plan; G

##### SD-11 Closeout Submittals

Transporter Certification of notification to EPA of their PCB waste activities and EPA ID numbers; G

##### Certification of Decontamination

Certificate of Disposal and/or recycling. Submit to the Government before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

##### DD Form 1348-1

##### Testing Results

#### 1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

- a. Disposable gloves (polyethylene)
- b. Eye protection
- c. PPE as required by CIH

#### 1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

#### 1.8 QUALITY ASSURANCE

### 1.8.1 Qualifications of CIH

Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph CERTIFIED INDUSTRIAL HYGIENIST. Submit [training certification](#) that the Industrial Hygienist is certified, including certification number and date of certification or re certification.

### 1.8.2 PCB and Lamp Removal Work Plan

Submit a job-specific plan within 20 calendar days after award of contract of the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan shall be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

### 1.8.3 PCB and Lamp Disposal Plan

Submit a PCB and lamp Disposal Plan with 45 calendar days after award of contract. The PCB and Lamp Disposal Plan shall comply with applicable requirements of federal, state, and local PCB and Universal waste regulations and address:

- a. Estimated quantities of wastes to be generated, disposed of, and recycled.
- b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state PCB and mercury-containing lamp waste permit applications and EPA identification numbers, as required.
- c. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.
- d. Spill prevention, containment, and cleanup contingency measures to be implemented.
- e. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerize daily.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

### 3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, and high intensity discharge (HID) lamps in accordance with local, state, or federal regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition

by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

### 3.1.1 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with [40 CFR 761](#), [40 CFR 262](#) [40 CFR 263](#), and the applicable requirements of this section, including but not limited to:

- a. Obtaining suitable PCB and mercury-containing lamp storage sites.
- b. Notifying Contracting Officer prior to commencing the operation.
- c. Reporting leaks and spills to the Contracting Officer.
- d. Cleaning up spills.
- e. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.
- f. Maintaining inspection, inventory and spill records.

## 3.2 PCB SPILL CLEANUP REQUIREMENTS

### 3.2.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills.

### 3.2.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

### 3.2.3 PCB Spill Cleanup

[40 CFR 761](#), subpart G. Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and disposed of as solid PCB waste.

### 3.2.4 Records and Certification

Document the cleanup with records of decontamination in accordance with [40 CFR 761](#), Section 125, Requirements for PCB Spill Cleanup. Provide test results of cleanup and [certification of decontamination](#).

## 3.3 REMOVAL

### 3.3.1 Ballasts

As ballast are removed from the lighting fixture, inspect label on ballast. Ballasts without a "No PCB" label shall be assumed to contain PCBs and containerized and disposed of as required under paragraphs STORAGE FOR DISPOSAL and DISPOSAL. If there are less than 1600 "No PCB" labeled lighting ballasts, dispose of them as normal demolition debris.

### 3.3.2 Lighting Lamps

Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as universal waste as specified herein.

### 3.4 STORAGE FOR DISPOSAL

#### 3.4.1 Storage Containers for PCBs

49 CFR 178. Store PCB in containers approved by DOT for PCB.

#### 3.4.2 Storage Containers for lamps

Store mercury containing lamps in appropriate DOT containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 273.

#### 3.4.3 Labeling of Waste Containers

Label with the following:

- a. Date the item was placed in storage and the name of the cognizant activity/building.
- b. "Caution Contains PCB," conforming to 40 CFR 761, CFR Subpart C. Affix labels to PCB waste containers.
- c. Label mercury-containing lamp waste in accordance with 40 CFR 273. Affix labels to all lighting waste containers.

### 3.5 DISPOSAL

Dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

#### 3.5.1 Identification Number

Federal regulations 40 CFR 761, and 40 CFR 263 require that generators, transporters, commercial storers, and disposers of PCB waste possess U.S. EPA identification numbers. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Uniform Hazardous Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work. For mercury containing lamp removal, Federal regulations 40 CFR 273 require that large quantity handlers of Universal waste (LQHUW) must provide notification of universal waste management to the appropriate EPA Region (or state director in authorized states), obtain an EPA identification number, and retain for three years records of off-site shipments of universal waste. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Universal Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

#### 3.5.2 Transporter Certification

Comply with disposal and transportation requirements outlined in 40 CFR 761



and 40 CFR 263. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Government. Return a signed copy to the Government before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities (EPA Form 7710-53).

#### 3.5.2.1 Certificate of Disposal and/or Recycling

40 CFR 761. Certificate for the PCBs and PCB items disposed shall include:

- a. The identity of the disposal and or recycling facility, by name, address, and EPA identification number.
- b. The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.
- c. A statement certifying the fact of disposal and or recycling of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.
- d. A certification as defined in 40 CFR 761.

-- End of Section --

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## SECTION 02 85 00

MOLD REMEDIATION  
11/18, CHG 1: 05/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN COLLEGE OF RADIOLOGY (ACR)

ACR MRI Accreditation Program Requirements,  
Latest Edition

## AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA IMOM08-679 (2008) Recognition, Evaluation, and  
Control of Indoor Mold

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2 (2018) Fundamentals Governing the Design  
and Operation of Local Exhaust Ventilation  
Systems

INSTITUTE OF INSPECTION, CLEANING, AND RESTORATION CERTIFICATION  
(IICRC)

ANSI/IICRC S520 (2015) Standard and Reference Guide for  
Professional Mold Remediation

IICRC S100 (2015) S100 Standard and R100 Reference  
Guide for Professional Cleaning of Textile  
Floor Covering

IICRC S500 (2015) Standard and Reference Guide for  
Professional Water Damage Restoration

## NAVY AND MARINE CORPS PUBLIC HEALTH CENTER (NMCPHC)

IHFOM, CH 13, Sec. 3 (2015) Mold Cleanup, Remediation, and  
Clearance Sampling

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

29 CFR 1926.59 Hazard Communication

29 CFR 1926.62 Lead

29 CFR 1926.1101 Asbestos

29 CFR 1926.1126 Chromium

29 CFR 1926.1127

Cadmium

UNDERWRITERS LABORATORIES (UL)

UL 586

(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

## 1.2 DEFINITIONS

### 1.2.1 AIHA

American Industrial Hygiene Association.

### 1.2.2 AIHA EMLAP

American Industrial Hygiene Association's Environmental Microbiology Laboratory Accreditation Program

### 1.2.3 AFU

Air filtration unit with High Efficiency particulate air (HEPA) filtered vacuum and exhaust ventilation equipment with a filter system capable of collecting and retaining microbial contamination [ASSP Z9.2](#). Filters must retain 99.97 percent of particles [0.000012 inches](#) or larger as indicated in [UL 586](#).

### 1.2.4 Categories of Water

Category 1 Water: Water that originates from a sanitary water source and does not pose a substantial risk from dermal, ingestion, or inhalation exposure. [IICRC S500](#)

Category 2 Water: Water that contains significant contamination and has the potential to cause discomfort or sickness if contacted or consumed by humans. Can contain potentially unsafe levels of microorganisms or nutrients for microorganisms as well as other organic or inorganic matter. [IICRC S500](#)

Category 3 Water: Water that is grossly contaminated and can cause significant adverse reactions to humans if contacted or consumed. [IICRC S500](#)

### 1.2.5 Certified Industrial Hygienist (CIH)

An individual that has been certified by the American Board of Industrial Hygiene (ABIH), with professional qualifications and experience as required for an industrial hygienist, as presented in the definition of "Industrial Hygienist."

### 1.2.6 Complete Interior Building Demolition (Complete Gut)

Interior finishes of the building have been removed to expose basic structural elements.

### 1.2.7 Containment

Physical separation and engineering controls required to prevent

contamination of undamaged materials and occupied areas. The level of containment varies depending on the extent of the contamination.

#### 1.2.7.1 Source Containment

Use when the contaminated surface area is less than 10 square feet, in both residential and non-residential buildings. At a minimum, source containment will include the following (ANSI/IICRC S520):

- a. Isolation of Work Areas. Install polyethylene barriers to isolate the areas or material to be demolished / remediated from non-remediation areas.
- b. Floor protection. Maintain protection for finished floors through all construction activities.
- c. HEPA vacuum to control dust created during the demolition. Hold HEPA vac intake at source of dust.

#### 1.2.7.2 Limited Containment

Use when contaminated surface area is between 10 square feet and 100 square feet per room in both residential and non-residential buildings. At a minimum, limited containment includes the following (ANSI/IICRC S520):

- a. Containment. For residential buildings, a containment includes the entire room where work is being performed. The containment does not extend past the extents of the room unless there are instances of contamination extending from one room to the next. For non-residential buildings, the containment includes the area to be remediated, plus enough additional area to allow for all equipment and work activities.
- b. Isolation of Work Areas. Install polyethylene barriers to isolate the areas to be demolished / remediated.
- c. Floor protection. Maintain protection for finished floors through all construction activities.
- d. Air Filtration / Pressurization Control. Install AFUs with HEPA filters in the containment. Configure the AFUs with splitters / diverters to allow some of the air to recirculate within the containment. Discharge the remainder of the air directly to the outside to maintain an overall negative pressure in the containment of 0.02 inch water column minimum to 0.04 inch water column maximum relative to the outside and other adjacent spaces not undergoing remediation (AIHA IMOM08-679). AFUs must filter a minimum of four air changes per hour and a maximum of six air changes per hour (ANSI/IICRC S520).
- e. Protection for all items remaining in the containment. Protective devices must prevent physical damage (e.g., scratches and dents) and must provide a positive seal to prevent dust from settling in or on the items.
- f. Decontamination. Construct a decontamination airlock for entry into and exit from the work area. HEPA vacuum the sealed bags of contaminated debris within the airlock. When possible, locate the decontamination airlock so that the sealed bags can be passed directly from the airlock to the outside, through a door or window.

- g. Containment Entrance. Install a triple-flap poly "door" to be used during demolition to provide a good separation between containment and occupied areas of the house / building.
- h. HVAC System. Seal off all supply and return vents. HVAC may need to be shut down to ensure proper seal of the vents.

#### 1.2.7.3 Full Containment

Use when contaminated surface area is greater than 100 square feet in both residential and nonresidential buildings. At a minimum, full containment includes the following(ANSI/IICRC S520):

- a. Containment. For residential buildings, a containment includes the entire room where work is being performed. The containment does not extend past the extents of the room unless there are instances of contamination extending from one room to the next. For non-residential buildings, the containment includes the area to be remediated, plus enough additional area to allow for all equipment and work activities.
- b. Isolation of Work Areas. Construct polyethylene barriers to isolate the areas to be demolished / remediated.
- c. Floor protection. Maintain protection for finished floors through all construction activities.
- d. Air Filtration / Pressurization Control. Install AFUs with HEPA filters in the containment. Configure the AFUs with splitters / diverters to allow some of the air to recirculate within the containment. Discharge the remainder of the air directly to the outside to maintain an overall negative pressure in the containment of 0.02 inch water column minimum to 0.04 inch water column maximum relative to the outside and other adjacent spaces not undergoing remediation (AIHA IMOM08-679). AFUs must filter a minimum of four air changes per hour and a maximum of six air changes per hour (ANSI/IICRC S520).
- e. Protection for all items remaining in the containment. Protective devices must prevent physical damage (e.g., scratches and dents) and must provide a positive seal to prevent dust from settling in or on the items.
- f. Decontamination. Construct a decontamination airlock for entry into and exit from the work area. HEPA vacuum the sealed bags of contaminated debris within the airlock. When possible, locate the decontamination airlock so that the sealed bags can be passed directly from the airlock to the outside, through a door or window.
- g. Containment Entrance. Install a triple-flap poly "door" at the entrance to the airlock, and between the airlock and the work area during demolition to provide a good separation between containment and occupied areas of the house / building.
- h. HVAC System. Seal off all supply and return vents. HVAC may need to be shut down to ensure proper seal of the vents.

#### 1.2.7.4 Unoccupied Building Containment

Use when a building is unoccupied and large amounts of mold growth are present throughout the building:

- a. Containment. The containment consists of the entire building. Install AFUs with HEPA filters in the building. Configure the AFUs to recirculate within the active remediation area. AFUs must filter a minimum of four air changes per hour and a maximum of six air changes per hour based on the size of the area undergoing active remediation (ANSI/IICRC S520).
- b. Isolation of Work Areas. Install polyethylene barriers to isolate remediation areas from non-remediation areas. AFU discharge may be used to positively pressurize non-remediation areas from areas undergoing remediation to prevent the movement of spores into "clean" areas.
- c. Floor Protection. Maintain protection for finished floors through all construction activities.
- d. Protection for all items remaining in the containment. Protective devices must prevent physical damage (e.g., scratches and dents) and must provide a positive seal to prevent dust from settling in or on the items.
- e. Decontamination. Construct a decontamination airlock for entry into and exit from the building.
- f. Containment Entrance. Install a triple-flap poly "door" to be used during demolition to provide a good separation between containment and non-remediation areas of the house / building.
- g. HVAC System. Seal off all supply and return vents. HVAC may need to be shut down to ensure proper seal of the vents.

#### 1.2.7.5 Cleaning Containment

For items being salvaged, set up a temporary containment structure to clean items removed from the containment. At a minimum, the cleaning area must contain:

- a. Two chambers. Construct walls with polyethylene. Clean the items in the first chamber. Store the clean items in the second chamber.
- b. Air Filtration / Pressurization Control Cleaning Chamber. Install AFUs with HEPA filters in the cleaning chamber. Configure the AFUs with splitters / diverters to allow some of the air to recirculate within the containment. Discharge the remainder of the air directly to the outside to maintain an overall negative pressure in the containment of 0.02 inch water column minimum to 0.04 inch water column (maximum) relative to the storage chamber (AIHA IMOM08-679).
- c. Air Filtration, Storage Chamber. Install AFUs with HEPA filters in the storage chamber. Configure the AFUs to allow air to recirculate within the chamber. AFUs must provide air filtration at a rate of between four and six air changes per hour (ANSI/IICRC S520).
- d. Containment Entrance. Install a triple-flap poly "door" at the entrance to the cleaning chamber, between the cleaning and storage chambers, and at the exit of the storage chamber to provide a good

separation between the chambers.

#### 1.2.8 Decontamination Unit (Airlock)

An enclosed area adjacent to, and connected to, a regulated work area. It consists of various rooms that are used for the decontamination of workers, equipment, and materials.

#### 1.2.9 Dehumidifier

Mechanism or machine to remove moisture from the air.

#### 1.2.10 Detergent

A cleaning agent. The term refers to a prepared compound that may include surfactants, builders, dry solvents, softeners, etc, but does not include true soap.

#### 1.2.11 [Disinfectants or Biocide Sanitizing Solutions](#)

One of three groups of antimicrobials registered by the EPA for public health uses. The EPA considers an antimicrobial to be a disinfectant when it destroys or irreversibly inactivates infectious or other undesirable organisms, but not necessarily their spores.

#### 1.2.12 EPA

U.S. Environmental Protection Agency.

#### 1.2.13 Fungal Growth Structures

Portions of fungi indicating active fungal growth is present on a surface. These include spores, conidiophores, hyphae, hyphal fragments, and mycelium.

#### 1.2.14 [Fungicidal Agents, \(EPA\)](#)

An EPA registered fungicide that inhibits the spread and growth of mold with the ability to withstand moist and humid conditions.

#### 1.2.15 HEPA Filter

A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97 percent of all particulate larger than [0.000012 inches](#).

#### 1.2.16 HVAC

Heating, Ventilating, and Air Conditioning (System).

#### 1.2.17 Industrial Hygienist (IH)

An individual designated and provided by the Contractor that is a professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational and indoor air quality hazards. Education must include a minimum 12 semester hours or quarter hour equivalent of chemistry and 18 additional semester hours or quarter hour equivalent of courses in any combination of chemistry, physics, engineering, health physics, environmental health, biostatistics, biology, physiology, toxicology, epidemiology, or industrial hygiene. The Industrial Hygienist must be a CIH or under the supervision



of a Certified Industrial Hygienist.

#### 1.2.18 Microbial Remediation Supervisor

Individual responsible for the execution of the microbial remediation work as defined by the scope of work. This individual must have documented training in microbial remediation and have at least three years experience in microbial remediation work. Remediation contractor's on-site supervisor must have one of the following certifications: Council-Certified Microbial Remediator (CMR), or Council-Certified Microbial Remediation Supervisor (CMRS) as certified by the American Council for Accredited Certification, or Applied Microbial Remediation Specialist (AMRS), Institute of Inspection, Cleaning, and Restoration Certification (IICRC) or Contracting Officer approved equivalent.

#### 1.2.19 Non-Porous Material

A material that does not absorb nor is easily penetrated by liquids, especially water. Generally, non-porous materials have a permeable factor of less than one. Some examples are metal, glass, plastic, ceramic tile.

#### 1.2.20 Occupied Spaces (Areas)

The phrase "occupied space" within this specification refers to spaces that are occupied by unprotected non-remediation personnel while work is in progress. It also refers to areas adjacent to work areas that are not currently undergoing remediation.

#### 1.2.21 Personal Protective Equipment (PPE)

Any material or device worn to protect a worker from exposure to, or contact with, any harmful material or force. PPE must be cleaned or disposed of prior to removal from the remediation work area.

#### 1.2.22 Poly

Polyethylene sheet with a minimum thickness of 6 mils (IHFOM, CH 13, Sec. 3).

#### 1.2.23 Porous Material

Permeable materials having the physical properties that allow liquids or gasses to pass through. These materials include but are not limited to the following: gypsum wall board, insulation, wallpaper, ceiling material, carpet, padding, paper goods (i.e., cardboard boxes, loose paper, books), stuffed furniture, wicker, fabrics.

#### 1.2.24 Pressure Differential Measuring Instrument

Device used to measure the relative pressure difference between the work area/containment and areas outside the work area. For mold remediation, the device must measure accurately in the 0 to 0.04 inch of water range.

#### 1.2.25 Semi-porous Material

A material that can absorb liquids if exposed over long periods of time. These materials include but are not limited to wood, concrete, linoleum, vinyl wall covering, wooden or hardboard furniture, plaster.

#### 1.2.26 Ventilation System Mold Remediator Qualifications (VSMR)

An individual certified by the North American Duct Cleaning Association (NADCA) to clean HVAC systems.

#### 1.2.27 Work Area

The area where remediation operations are actively performed and controlled to prevent the spread of dust / spores and entry by unauthorized personnel. A work area is the space, group of spaces, or the building, as defined by the Microbial Assessment Survey.

### 1.3 REQUIREMENTS

#### 1.3.1 Description of Work

The Contracting Officer will furnish the Contractor, in the contract documents, an initial Microbial Assessment Survey with containment categories and remediation methods specified for each work area and material within the work area.

- a. The Contracting Officer's initial Microbial Assessment Survey specified below must be furnished and certified by a qualified assessor authorized by the Contracting Officer to do such work. The initial survey is included in the solicitation documents at the end of this specification section.
- b. Provide mold remediation work including the handling and control of mold contaminated materials and the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with mold products and spores. The work also includes the disposal of any mold contaminated materials generated by the work. The mold removal work includes the demolition and removal of items as identified in the Statement of Work as identified during site visit and as shown on drawings. Provide containment and engineering control techniques as outlined in this specification. All mold contaminated material removal work must be supervised by a microbial remediation supervisor as specified herein.
- c. No work in this specification section can be provided by any person, contractor, or contracting entity involved in the preparation of the contract documents of which this specification section is a part.
- d. The following microbial remediation specifications apply to the cleaning / removal and disposal of fungally-contaminated porous, semi-porous and non-porous surfaces within various types of structures. The level of containment and requirements for cleaning and remediation of materials will depend on the condition of the space and materials being remediated.
- e. Immediately after award of the contract, prepare a preliminary visual assessment report using the standard microbial assessment form (Appendix A) to document the differences in the pre-remediation condition of the work areas as compared to the government provided Microbial Assessment Survey. Coordinate inspection with contracting officer. Only address the differences between the pre-remediation condition of the work areas and the government provided Microbial Assessment Survey. If required to indicate the differences, include the HVAC systems inspection required elsewhere in this specification

section. Submit this written pre-remediation condition report to the Contracting Officer for approval and instructions to proceed.

- f. After approval of the preliminary visual assessment report and having instructions from the Contracting Officer to proceed, prepare a microbial remediation plan for approval by the Contractor's Certified Industrial Hygienist. Include an assessment of the risk for people occupying areas adjoining the remediation area while remediation work is occurring in the microbial remediation plan. Upon the Contractor's CIH approval of the plan, submit the plan to the Contracting Officer for approval.
- g. The Contractor's CIH or IH must monitor the site on a daily basis while remediation work is in progress, identifying work and work practices that are not in compliance with the approved microbial remediation plan, and performing all inspections required by this specification. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the contract.
- h. This specification section includes the protocol regarding proper disposal of the removed building material components from within the work site.
- i. Use proper cleaning procedures, engineering controls, and apply best management practices to remove microbial growth and spore fallout from all surfaces and building materials to minimize the further release of microbial spores. Address semi-porous and nonporous surfaces within the facility in each cleaning phase of the project. Damp wipe and HEPA vacuum all surfaces, at a minimum. Remove and dispose of porous building materials that are supporting microbial growth.

### 1.3.2 Security Requirements

Prior to granting access to any work area (i.e., building, area, room, or space) for mold remediation work, a determination must be made by the government agency whether classified or controlled unclassified information (paper material or electronic media) or equipment is contained in the work area(s).

It may be necessary depending on the sensitivity of the work area or the information contained in the area to authorize the Government activity or tenant command responsible for the work area to provide their own appropriately cleared military or government personnel to properly remove or secure any classified or controlled unclassified information, electronic media or equipment located in their work area(s). Prior authorization would be required and the area would need to be evaluated to ensure it is safe for personnel to enter and all personnel must utilize the required PPE to safely enter the work area.

- a. If Contractor personnel require access to classified information or spaces to perform mold remediation work, the Government must issue the Contractor facility a Facility Clearance Level (FCL) (Contract Security Classification Specification) prior to the initiation of the work under the contract. If the Contractor facility does not possess a valid FCL issued by the Defense Security Service (DSS), the Government will be required to submit a sponsorship request to DSS requesting that the Contractor be processed for and issued a current FCL at the appropriate level.

- b. Access to classified information (paper material, electronic media, and equipment) must only be granted to authorized and appropriately cleared government and U.S. contractor personnel that possess a personnel security clearance commensurate with the level of information contained in the work area that requires a mold remediation effort.
- c. Access to Controlled Unclassified information (i.e., For Official Use Only, Sensitive but Unclassified, Privacy Act Information, Export Controlled unclassified) can be granted to DOD cleared contractors, consultants and grantees that are conducting official business for the DOD or DON. Non-cleared U.S. contractor personnel who only require access to controlled unclassified information can be granted access if they get a favorable trustworthiness determination on an individual Favorable Tier 1 investigation and fingerprint result submitted on their behalf by the government agency issuing the contract.
- d. Classified information and controlled unclassified information must be safeguarded / secured, reproduced, and destroyed in accordance with SECNAV M-5510.36.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

Ventilation System Mold Remediator Qualifications (VSMR); G

Preliminary Visual Assessment Report; G

Microbial Remediation Plan; G

Respiratory Protection Program; G

Worker Records;

Certified Industrial Hygienist (CIH)/Industrial Hygienist (IH) Qualifications; G

Microbial Remediation Supervisor Qualifications; G

##### SD-03 Product Data

Disinfectants or Biocide Sanitizing Solutions; G

Fungicidal Agents, (EPA); G

Personal Protective Equipment (PPE); G

Pressure Differential Measuring Instrument;

Safety Data Sheets (SDS) for All Materials; G

Dehumidifiers;

Air Filtration Units;

SD-06 Test Reports

IH Daily Reports; G

SD-11 Closeout Submittals

Submittals at Completion of Remediation Work; G

#### 1.4.1 Preconstruction Submittals

Within 10 days from the award of the contract and prior to the start of the work, submit to the Contracting Officer six copies of the following items for review and permanent file.

##### 1.4.1.1 Preliminary Visual Assessment Report

A written report to document the pre-remediation condition of the work areas compared to the government provided Microbial Assessment Survey and the results of the HVAC systems inspection.

##### 1.4.1.2 Microbial Remediation Plan

Submit a job-specific, abbreviated plan Approved by the Contractor's CIH to the Contracting Officer for final approval prior to start of work. The plan must address the following items at a minimum:

- a. Description of materials to be remediated, providing location and quantities (map if available), and methods to be used for remediation.
- b. Products: Disinfectants, detergents, biocides, sanitizing solutions, and fungicidal agents, (EPA).
- c. Containment procedures to include description and locations of engineering controls and decontamination unit to include entry and exit procedures (provide sketch of floor plan showing location of containment barriers and decontamination units). Include locations of AFUs and AFU discharges to the outside.
- d. Description of personal protective equipment to be used during the remediation.
- e. Construction barricades and barriers in occupied areas.
- f. HVAC Shut down and start-up procedures.
- g. HVAC Evaluation and remediation procedures.
- h. Moisture and relative humidity control procedures and equipment.
- i. Packaging and disposal procedures.
- j. Safety Precautions to include lockout / tag-out, fall protection, confined space entry procedures, and fire protection.
- k. Description of the method to be employed to control cross contamination of areas not in the work area. Include a risk assessment related to

the suitability of people to occupy areas adjoining the remediation area while remediation activities are ongoing.

- l. IH Quality Control procedures to include visual inspection.
- m. Procedures to control, abate, and dispose of Asbestos Containing Materials (ACM), Presumed Asbestos Containing Materials (PACM) and Lead Based Paint (LBP) coincident with microbial remediation. ACM, PACM, and LBP must be identified before work begins; Identify the presence, location, and quantity of ACM, PACM, and LBP therein pursuant to paragraphs (g), (k) (1) of 29 CFR 1926.1101 and for lead 29 CFR 1926.62.

#### 1.4.1.3 Respiratory Protection Program

Provide written copy of Contractor's Respiratory Protection program.

#### 1.4.1.4 Worker Records

Provide the following documents for all workers, including supervisory personnel. If new workers are added to the crew, provide the same documentation for them.

Employee Instruction and Release Form: Provide documentation showing that each employee has been instructed on the following items:

- a. Use and fit of respirators (for employees entering and working in the containment).
- b. Protective clothing.
- c. Protective measures.
- d. Safety and Emergency Egress Procedures.
- e. Site specific fall protection plan and training.
- f. Microbial remediation hazards and practices including engineering controls and isolation. Training should include "hands on" training for microbial remediation supervisors.
- g. Workers' release forms stating the potential hazards involved with the scope of the work.

Worker Training Certification: Submit copies of training certificates for each employee indicating that the employee has received training at the appropriate level for the work prescribed in the description of work.

#### 1.4.1.5 Certified Industrial Hygienist (CIH)/Industrial Hygienist (IH) Qualifications

Submit the name, address, and telephone number of the Certified Industrial Hygienist (CIH) and Industrial Hygienist (IH). Provide copies of board certificates, resume to document field experience, and evidence that the CIH and IH have successfully completed training in microbial investigation and remediation.

#### 1.4.1.6 Microbial Remediation Supervisor Qualifications

Onsite supervisor must have one of the following certifications: Certified Microbial Remediator (CMR), Certified Microbial Remediation Supervisor (CMRS), or Applied Microbial Remediation Specialist (AMRS). Submit copies of supervisory training certificates.

#### 1.4.2 Product Data

Within 10 days of contract award, submit product data for items identified for use in Microbial Remediation Plan.

#### 1.4.3 IH Daily Reports

Prepare a written IH Daily Report for each day that microbial remediation work is being accomplished. Submit the IH Daily Report to the Contracting Officer by 1000 hours of the following day. The IH Daily Report at a minimum must include measurements of differential pressure and temperature and relative humidity in work areas, and detail any non-compliance issues observed.

#### 1.4.4 Submittals at Completion of Remediation Work

Within 14 days of completion, provide the following information:

- a. Daily Project Logs.
- b. IH Daily Reports.
- c. Photographic Logs.
- d. Contractor's Industrial Hygienist Report certifying the microbial remediation is complete.

### 1.5 RECORD KEEPING

A Daily Project Log must form a permanent record of the project. Secure and maintain these logs and any other required documentation as part of the permanent project file.

#### 1.5.1 Daily Project Log

The Microbial Remediation Supervisor must maintain a Daily Project Log. The Daily Project Log must be used each day of the project to document the following information.

- a. Date.
- b. Name of Microbial Remediation Supervisor.
- c. Name of Industrial Hygienist monitoring work area.
- d. Number of workers on site.
- e. Equipment utilized.
- f. Brief description of daily work activities.
- g. Listing of any non-compliance noted, emergencies, stop work orders (with detailed explanation), and descriptions of any other significant events.

## PART 2 PRODUCTS

### 2.1 DISINFECTANTS, BIOCIDES, SANITIZING SOLUTIONS AND FUNGICIDAL AGENTS, (EPA)

Must be EPA Registered for the use detailed in the Microbial Remediation Plan and used in accordance with the manufacturer's specifications.. Provide SDS sheets to the Contracting Officer for any chemicals that will be used during the performance of the work for approval.

### 2.2 HAZARD COMMUNICATION

Adhere to all parts of [29 CFR 1926.59](#) and provide the Contracting Officer with a copy of the [Safety Data Sheets \(SDS\) for all materials](#) brought to the site.

## PART 3 EXECUTION

### 3.1 EQUIPMENT

Provide manufacturer's certificate of compliance for all equipment used to contain the microbial contamination.

#### 3.1.1 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services. Provide personnel engaged in set-up, pre-cleaning, cleanup, handling, and removal of contaminated materials with the appropriate respiratory protection as specified in [29 CFR 1910.134](#). Microbial remediation plan must consider Table 17.1 in [AIHA IMOM08-679](#) "Recognition, Evaluation, and Control of Indoor Mold", which lists the minimum levels of respiratory protection based on the activity and size of the remediated area.

#### 3.1.2 Protective Clothing

Provide all workers with protective clothing as appropriate for the work being accomplished, as required by the Microbial Remediation Plan.

#### 3.1.3 Warning Signs and Labels

Provide warning signs printed in English and at all approaches to the work areas [IICRC S500](#). Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Warning signs may be in the form of continuous plastic tape. The warning signs must have black characters on a yellow background.

WARNING  
DO NOT ENTER  
MICROBIAL REMEDIATION WORK IN PROGRESS

Alternate wording for the warning signs will be approved by the Contracting Officer.

#### 3.1.4 [Dehumidifiers](#)

Install and use dehumidifiers as needed during the remediation to maintain



relative humidity below 60 percent in the work area. Drain the condensate water to a permanent drain, or empty as needed to prevent water overflowing from the dehumidifiers. IHFOM, CH 13, Sec. 3

### 3.1.5 Air Filtration Units (AFU)

Install and use AFUs with HEPA filters, and manufacturer specified pre-filters, as part of the exhaust ventilation system to develop and maintain the specified desired air pressure differential inside the enclosed work area relative to the outside areas. Acquire and pay for any licenses needed for use of any equipment, including but not limited to, air pressure differential systems and air filtration systems.

- a. Replace HEPA filters and pre-filters for AFUs as required to maintain pressurization performance requirements during demolition and cleaning. Do not reuse filters. Bag used filters at a minimum in clear 6 mil (IHFOM, CH 13, Sec. 3) polyethylene bags within the containment and disposed as contaminated waste.
- b. Discharge air from any AFUs located in the work area containment to the outside environment when creating a negative pressure containment to create a negative pressure relative to the outside and adjacent work areas not undergoing active remediation of 0.02 inch H<sub>2</sub>O to 0.04 inch H<sub>2</sub>O AIHA IMOM08-679. Discharge air in excess of that required for creating the proper negative pressure to the work area. The AFUs must provide four to six air changes per hour in the work area (ANSI/IICRC S520). Under no circumstances may air from AFUs discharge to an occupied area. Coordinate location of window sashes or doors required for discharge openings with the Contracting Officer. Exhaust discharge openings may be constructed of plywood, and the seals around such opening must be airtight.
- c. Seal all exhaust and intake openings in AFUs with one layer of 6 mil (IHFOM, CH 13, Sec. 3) polyethylene sheeting when not in use.

### 3.1.6 Vacuum Cleaners Equipped with HEPA Filters

Provide vacuum cleaners equipped with HEPA filters designed for continuous operation in order to complete the work in a timely and efficient manner.

- a. Provide nozzle attachments as required to adequately remove all dust. As a minimum, nozzle attachments must include crevice and extended bristle brush nozzles. Any vacuum that is not equipped with a HEPA filter must not be used at anytime.
- b. Provide sufficient vacuum cleaners equipped with HEPA filters designed for continuous operation in the work area during microbial remediation inside the containment area.
- c. Provide additional vacuum cleaners equipped with HEPA filters in the enclosed work area during remediation or cleaning work as required by the size (area) of the containment and to maintain timely progress of the work.

## 3.2 GENERAL REQUIREMENTS

### 3.2.1 Pre-Microbial Remediation Work Conference

Meet with the Contracting Officer prior to beginning work to discuss in

detail the Microbial Remediation Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if a part of this specification. Any variances to the specification as a result of the plan must be specifically identified to allow for free discussion and approved by the Contracting Officer in writing prior to starting work. Before work in areas with Asbestos Containing Materials (ACM), Presumed Asbestos Containing Materials (PACM) and Lead begins, identify the presence, location, and quantity of ACM, PACM and Lead. Ensure proper notification of regulatory authorities. Consult with Contracting Officer to obtain facility ACM / LBP surveys. Mitigate any disturbance of painted/coated surfaces in accordance with 29 CFR 1926.62, 29 CFR 1926.1126 and 29 CFR 1926.1127.

### 3.2.2 Containment Entry / Exit Procedure

Ensure that each worker and authorized visitor follows entry and exit procedures detailed in the Microbial Remediation Plan.

## 3.3 REMOVAL PROCEDURES

### 3.3.1 Protection of Existing Work Areas

Perform work in a manner to minimize the damage or contamination to areas outside or directly adjacent to the work area. Inspect areas inside and outside proposed work areas to identify existing damage and notify Contracting Officer prior to start of work.

Where materials outside work area are damaged or contaminated as a result of the Contractors work efforts as verified by the Contracting Officer using visual inspection or sample analysis, it must be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting officer. Should adjacent or outside areas become contaminated as a result of the Contractors work efforts, stop work immediately. Clean the newly contaminated areas at no additional expense to the Government. The work may proceed at the discretion of the Contracting Officer once the area has been verified by visual inspection as restored.

### 3.3.2 Remediation of Fungally Contaminated Building Materials

The removal of contaminated materials must follow in general the listed sequence of work. The Contractor may make changes to improve work flow with the approval of the Contracting Officer.

- a. Provide level of containment and PPE required by the Microbial Remediation Plan.
- b. Disable all HVAC units and exhaust fans in the area to be remediated. Cover and seal all supply vents, return vents, and air handling units in the project area using two layers of 6 mil poly (IHFOM, CH 13, Sec. 3).
- c. Protect materials to remain in work area. Where possible, clean all materials to be salvaged in place to prevent possible cross-contamination created by moving materials through non-remediation areas.
- d. Remove undamaged items and materials to be cleaned and salvaged from the work area. Store materials in an area with relative humidity

maintained below 60 percent and where temperatures will not damage the material. Notify Contracting Officer of existing damage to items prior to removal.

- e. Set up containments, including protection of materials remaining within the containment and AFUs. Notify Contracting Officer that the area is prepared for remediation activities.
- f. Pre-demolition inspection by the Contracting Officer.
- g. Demolition and removal / cleaning of contaminated materials.
- h. Post-remediation inspection by the Contracting Officer.
- i. Perform final cleaning in the containment.
- j. Clean carpet in the containment if salvageable.
- k. Clearance inspection by the Contracting Officer.
- l. Duct and HVAC cleaning, if necessary.
- m. Deconstruction of containment, removal of AFUs.
- n. Return previously items that were removed and cleaned to the occupied area.

### 3.3.3 Remediation Procedures

#### 3.3.3.1 Remediation of Non-Porous Materials

Method of remediating non-porous items:

- a. HEPA vacuum all surfaces.
- b. Damp wipe all surfaces using clean water or a detergent solution.
- c. Ensure all cleaned surfaces are dried thoroughly.

#### 3.3.3.2 Semi-Porous Materials (Unfinished Wood)

Use this method for remediating unfinished wood-based items, including wood and wood framing in wall cavities:

- a. Cleaning
  - (1) HEPA vacuum all surfaces.
  - (2) Scrub surfaces with a brush and detergent to remove mold.
  - (3) Ensure all cleaned surfaces are dried thoroughly.
  - (4) HEPA vacuum all surfaces to remove dust.
  - (5) Repair finishes as required to match original.

- b. Removal

Where unfinished wood product has been structurally damaged, remove and

replace with an equivalent product. This includes wall studs and sheathing, such as OSB used in flooring, wall, or roof construction. Lightly mist mold contaminated material before removal.

#### 3.3.3.3 Semi-Porous Materials

Use this method for surface cleaning semi-porous materials such as concrete, vinyl wall covering, linoleum, leather furniture, and finished wood products:

- a. HEPA vacuum all surfaces.
- b. Damp wipe surfaces using clean water or a detergent solution. Avoid over-wetting the material. Ensure all materials are dried thoroughly

#### 3.3.3.4 Porous Materials

##### a. Carpet

- (1) Removal: Remove carpet that has remained wet for 48-hours or longer (AIHA IMOM08-679). If carpet has dried out, lightly mist before removal.
- (2) Cleaning (for carpet that has been wet for less than 48-hours) AIHA IMOM08-679: Use a dry absorbent compound cleaning method as designated by IICRC S100. This method uses an absorbent compound to dissolve, suspend and absorb carpet soils. It does not add moisture back into the carpet. Ensure carpet is dried thoroughly after cleaningb. Gypsum Wallboard (GWB)

- (1) Removal: Remove Gypsum Wallboard that has remained wet for 48-hours or longer (AIHA IMOM08-679), or has visible mold growth. Where removal of GWB exposes insulation, remove the insulation. Lightly mist all contaminated materials before removal.
- (2) Surface Cleaning: Where GWB has a small amount of surface mold growth and the GWB is structurally sound, a surface cleaning method may be used with the permission of the Contracting Officer. HEPA vacuum all surfaces and wipe down with a detergent solution. Do not use surface cleaning where mold growth penetrates wallboard substrate. Thoroughly dry the cleaned areas and paint to lock down any residual spores.

##### c. Ceiling Tile

- (1) Removal: Remove ceiling tile that has remained wet for 48-hours or longer, or has visible mold growth (AIHA IMOM08-679). If ceiling tile has dried out lightly mist before removal.3.4

#### DETAILED SEQUENCE OF WORK FOR MOLD REMOVAL UNDER CONTAINMENT

#### 3.4.1 Preparation for Remediation Work

- a. Provide level of containment and PPE required for the remediation based on the Microbial Remediation Plan.
- b. Disable all HVAC units and exhaust fans in the area to be remediated.
- c. Remove undamaged materials from the work area if they are to be salvaged but cannot be cleaned in place. Store materials in an area

with relative humidity maintained below 60 percent (IHFOM, CH 13, Sec. 3) and where temperatures will not damage the material. Notify Contracting Officer of existing damage to items prior to removal. Clean materials using procedures detailed in Remediation Procedures.

- d. Remove supply diffusers, return grilles and exhaust grilles. Clean diffusers and grilles using procedures detailed in Remediation Procedures.
- e. Construct containment barriers. Existing walls can be used as a portion of the containment barriers if existing openings in walls (such as doors, wall openings, vents) are sealed using 6 mil polyethylene.
- f. Install the AFUs and dehumidifiers.
- g. Seal supply, return, and exhaust openings with 6 mil polyethylene sheeting and protect intakes to air handling units. Air handling units are to remain off.
- h. Install all equipment needed for removal work in the containment area to minimize egress during demolition.
- i. The Contracting Officer will inspect the containment to verify that the containment is properly constructed and the containment area has an overall negative pressure of 0.02 to 0.04 inch water column AIHA IMOM08-679 relative to the outside and adjacent work areas not undergoing active remediation, prior to beginning demolition work.

#### 3.4.2 Demolition

- a. Remove mold contaminated materials to be discarded, such as paper, and furniture. Double bag material in 6 mil (IHFOM, CH 13, Sec. 3) poly bags. Seal poly bags using duct tape inside the containment. HEPA vacuum bags before removing them from the containment or airlock. When possible, pass the bags directly from the containment or airlock to the outside. Transport bags to a dumpster. Do not leave the bags at the building / house.
- b. Lightly mist all contaminated materials that are being discarded to minimize generation of airborne mold spores during demolition/removal.
- c. Remove contaminated gypsum wallboard (GWB) at the preliminary limits of demolition specified in the Microbial Remediation Plan. Inspect back side of removed GWB. If mold is observed on the back side of the GWB, report this condition to the Contracting Officer. After obtaining Contracting Officer approval, continue removing GWB until no mold is observed. If hidden mold is discovered that will extend past the extents of the containment, stop work immediately and reconstruct the containment to extend past the suspected contamination. Re-evaluate level of containment and PPE. Continue to operate AFUs during reconfiguring of containment.
- d. Remove drywall by cutting in pieces as large as possible to minimize aerosolization of fungal spores. Drywall screws can either be backed out during removal or later during cleanup.
- e. Use dust collection attachments on all power tools, such as sanders, saws, to capture dust created when using the tools. Outlet of dust collector should discharge into inlet of AFU.

- f. Remove fiberglass insulation behind removed gypsum board.
- g. If wood studs are contaminated, HEPA vacuum all surfaces, scrub them with a brush and detergent to remove mold. After scrubbing studs, HEPA vacuum again to remove any remaining dust. Replace wood studs with damage severe enough to reduce the structural capacity of the member. Prior to removal of any structural member consult with the Contracting Officer.
- h. Clean all metal framing with a dilute detergent solution. Clean metal framing with light rust using steel wool and coat with a rust inhibiting paint. Replace metal framing with rust damage severe enough to reduce the structural capacity of the member. Prior to removal of any structural material, consult with the Contracting Officer.
- i. Remove contaminated carpet scheduled for removal.
- j. Place removed gypsum board, insulation, carpet and remaining debris in two layers of 6 mil (IHFOM, CH 13, Sec. 3) poly bags. Seal poly bags using duct tape inside the containment. HEPA vacuum bags before removing them from the containment or airlock. When possible pass the bags directly from the containment or airlock to the outside. Transport bags to a dumpster. Do not leave the bags at the building / house.
- k. Remediation workers must HEPA vacuum their PPE, then remove their PPE within the containment area. Discard disposable coverall suits into a 6 mil (IHFOM, CH 13, Sec. 3) poly bag.

#### 3.4.3 Post-Demolition Inspection

- a. The Contracting Officer will inspect the containment area to verify that all contaminated materials have been removed.
- b. Allow a minimum of 12-hours after completion of removal work, with AFUs operating, for airborne dust in the containment to settle or be removed by the AFUs.

#### 3.4.4 Cleaning after Demolition, and Cleaning of Settled Spores from Porous / Non-Porous Materials

- a. Continue to operate AFUs during cleaning.
- b. Clean exposed surfaces.
  - (1) HEPA vacuum all surfaces.
  - (2) Damp wipe all non-porous exposed surfaces including polyethylene sheets used to protect materials, external surfaces of ductwork, studs, and floors with clean rag and clean potable water or detergent solution.
  - (3) Remove poly sheeting inside the containment.
  - (4) HEPA vacuum all surfaces protected by poly sheeting.
  - (5) Damp wipe non-porous surfaces protected by poly sheeting with clean water or a detergent solution.
  - (6) Clean carpet using

procedures previously specified in paragraph POROUS MATERIALS above.

- c. Final clearance inspection will be conducted by Contracting Officer. Clearance inspections will be performed using the procedures detailed in Post-Remediation Inspection. If areas fail final clearance inspections, additional corrective actions taken by the contractor will be at no additional cost to the Government. Maintain containments in place until spaces are inspected and accepted by the Government as being fully remediated. The Government will determine whether additional cleaning is required by the Contractor and whether the clearance process will be repeated.

### 3.5 DUCT AND HVAC SYSTEM CLEANING

#### 3.5.1 Contractor Qualifications

- a. The HVAC cleaning contractor must be a certified member of NADCA.
- b. The HVAC cleaning contractor must have at least one individual with Ventilation System Mold Remediator Qualifications certified by NADCA onsite during duct and HVAC system cleaning.

#### 3.5.2 Inspection

IH must visually inspect the HVAC system serving all work areas (or as required in the initial Microbial Assessment Survey performed by the Government), and determine if additional remediation is needed to clean the HVAC system, thus preventing re-contamination. Coordinate inspection with the contracting officer. Notify the Contracting Officer of the inspection results. The Contractor must receive written approval from the Contracting Officer before proceeding with HVAC microbial remediation.

#### 3.5.3 HVAC Microbial Remediation

Conduct the following actions if authorized by the Contracting Officer.

- a. Follow requirements of the NADCA ACR "Standard for Assessment, Cleaning, and Restoration of HVAC Systems".
- b. Using a "gassing" or "fogging" method of cleaning with gaseous chlorine dioxide or ozone is not allowed.
- c. Disable all HVAC equipment prior to cleaning any component of the system.
- d. Use this method for cleaning the air handling units, terminal units, blowers and exhaust fans:
  - (1) Construct a limited containment around equipment to be cleaned. Provide appropriate PPE for workers.
  - (2) Remove filters. Seal filters in 6 mil (IHFORM, CH 13, Sec. 3) poly bags for disposal.
  - (3) Disassemble units as necessary to clean components. Contractor is responsible for correctly reassembling equipment after cleaning.
  - (4) Clean disassembled components within the containment or in a

separate two chamber cleaning containment. Seal disassembled components in 6 mil (IHFOM, CH 13, Sec. 3) poly bags for transport out of building / house. HEPA vacuum bags before removing them from the containment or airlock.

- (5) HEPA vacuum all surfaces.
  - (6) Damp wipe all non-porous surfaces and components with clean water or a detergent solution.
- e. Use this method for cleaning HVAC coils:
- (1) Clean coils using a method which will render the coil visibly clean. Coil cleaners must be non-acidic / alkaline, detergent based. Clean condensate drain pans. The drain for the condensate drain pan must be operational during the cleaning.
  - (2) Rinse coils and drain pans with clean water to remove any latent residues.
  - (3) Cleaning methods must not cause damage to the coil surface or fins.
  - (4) Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil is considered clean only if the coil is free of foreign matter and chemical residue.
- f. Use this method for cleaning the duct system:
- (1) During cleaning, connect a vacuum collection system to the downstream end of the section being cleaned. The vacuum collection device must be of sufficient power to render all areas of duct being cleaned under negative pressure relative to rooms and areas of duct not being cleaned. Negative pressure must be verified at the furthest point from the collection system with a micromanometer and verification measurements included in the IH Daily Report.
  - (2) Equip the vacuum collection systems with HEPA filters. Exhaust the vacuum collection systems directly to the outside.
  - (3) Use mechanical agitation devices to dislodge debris adhered to the ductwork, such that debris may be safely conveyed to vacuum collection devices. Cleaning methods must not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork.
  - (4) HEPA vacuum duct surfaces.
  - (5) When possible, damp wipe metal duct surfaces with clean water or detergent solution. Do not wet fibrous glass thermal or acoustical insulation.
  - (6) Identify areas where there is evidence of damage to or uncleanable mold in duct insulation. The Contracting Officer will make the decision to discard the insulation, if necessary.
- g. Final clearance of HVAC and duct system will be based on a visual



assessment (no visible dust, no visible mold) by Contracting Officer. If HVAC fails final clearance inspection, additional corrective actions taken by the contractor will be at no additional cost to the Government.

### 3.6 FIRE PROTECTION

Provide portable fire extinguishers within the containment area and outside the decontamination unit. Fire extinguishers Must be rated for the class of fire hazards in the work area and must be sized for coverage of the areas within the containment. At a minimum, one 10 pound ABC fire extinguisher for every 1,000 square feet must be strategically placed around the containment. Personnel must be trained for emergency egress and the use of fire extinguishers. Notify fire officials of work activities as required. IICRC S500

### 3.7 CONSTRUCTION BARRIERS

- a. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain. Shoring, bracing or support will be necessary when structural wood studs or metal framing need to be removed and replaced when they cannot be cleaned.
- b. Do not disturb microbial-contaminated building materials while isolating work areas. This precaution prevents the release of microbial spores.
- c. Workers must wear PPE as outlined in the microbial remediation plan when installing critical barriers where microbial contaminated surfaces (walls or surfaces with visible settled dusts) are likely to be disturbed. Operate an AFU if disturbance is likely during setup.
- d. Monitor the air pressure differential across work area containments. The monitoring system must be in place before the start of remedial activities. Verification by the Industrial Hygienist is required prior to the start of the microbial remediation.

### 3.8 QUALITY ASSURANCE / QUALITY CONTROL REQUIREMENTS

#### 3.8.1 Contractor Qualifications

Work must be performed by a qualified remediation contractor. Contractor must carry insurance that specifically covers mold remediation.

- a. Remediation contractor's on-site supervisor must have one of the following certifications: Certified Microbial Remediator (CMR), Certified Microbial Remediation Supervisor (CMRS), or Applied Microbial Remediation Specialist (AMRS). Qualified supervisor must be onsite whenever active remediation is being performed. Set-up activities may be performed without supervisor present; qualified supervisor must review set-up prior to start of work.
- b. Mold remediation workers must be given training in PPE and mold remediation activities as required for their particular job. Microbial remediation plan must provide details of worker training.

#### 3.8.2 Waste Management and Removal

Keep the site and work area free from accumulations of dust, waste

materials, or rubbish caused by Contractor operations and free from any flammable materials or other sources of fire hazard. Remove all waste materials and rubbish from and about the work site in strict accordance with the specifications and applicable codes and regulations.

### 3.8.3 Post-Remediation Inspection

Clean up all debris and dust in interior spaces outside the work area resulting from the Contractor's remediation work.

After all visible accumulations of material and debris are removed from the containment, provide the Contracting Officer a 24-hour notice for a final clearance visual inspection. The Contracting Officer and Contractor's Industrial Hygienist must conduct a thorough visual inspection of the work area. If during this inspection any visible debris or microbial contamination are observed, the Contractor must re-clean the work area without additional cost to the Government.

#### 3.8.3.1 Clearance

##### a. Clearance Criteria

Clearance will be based on visual assessment (all visible mold removed, all visible dust removed, based on a "white glove" test) by Contracting Officer. "White glove" test will consist of wiping the surface with a clean cloth of color suitable to reveal expected type of dust. For most surfaces, a white cloth is suitable. For GWB dust, a dark cloth may be more appropriate.

- b. Failed remediation areas will be recleaned at no additional cost to the Government and the AFUs kept in operation another 12-hours, followed by another visual assessment. Subsequent failures will follow the same routine until a pass condition is secured.

### 3.9 CLEAN-UP AND DISPOSAL

#### 3.9.1 Disposal of Material

Dispose of contaminated bagged waste materials removed during this remediation as general construction debris. Follow all applicable local, State, and Federal requirements for the disposal of this material.

#### 3.9.2 Material Packaging

Place waste, as waste is removed, into a disposal container promptly. Disposal containers must consist of at a minimum, two layers of clear 6 mil (IHFORM, CH 13, Sec. 3) polyethylene bags. Tape bags in a gooseneck fashion to form an airtight seal and label appropriately. Bag waste from vacuums equipped with HEPA filters in 6 mil (IHFORM, CH 13, Sec. 3) polyethylene bags.

#### 3.9.3 Building Exit (Waste Disposal)

HEPA vacuum and damp wipe bags of contaminated waste material prior to removal from the building. When possible pass the bags directly from the containment area to the outside. Transport bags to a dumpster.

#### 3.9.4 Hazardous Material

Should the Contractor encounter any hazardous materials, notify the

Contracting Officer immediately for direction.

3.10 APPENDICES

Appendix A - Microbial Assessment Visual Field Report Form

Appendix A

Microbial Assessment Visual Field Report Form

TO DOWNLOAD THIS FORM, SEE UFGS FORMS, GRAPHICS AND TABLES

Go to

<http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>

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## SECTION 03 30 00

## CAST-IN-PLACE CONCRETE

02/19, CHG 4: 08/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 213R	(2014; E2017) Guide for Structural Lightweight-Aggregate Concrete
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305.1	(2014) Specification for Hot Weather Concreting
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel
ASTM INTERNATIONAL (ASTM)	
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A184/A184M	(2019) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2016) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2017) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A820/A820M	(2016) Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
ASTM A884/A884M	(2019) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A955/A955M	(2020c) Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement
ASTM A970/A970M	(2018) Standard Specification for Headed Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

ASTM A1022/A1022M	(2016b) Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement
ASTM A1044/A1044M	(2016a) Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete
ASTM A1055/A1055M	(2016) Standard Specification for Zinc and Epoxy Dual Coated Steel Reinforcing Bars
ASTM A1060/A1060M	(2016b) Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1094/A1094M	(2020) Standard Specification for Continuous Hot-Dip Galvanized Steel Bars for Concrete Reinforcement
ASTM C31/C31M	(2021a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2020) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2022) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air

	Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C311/C311M	(2022) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C330/C330M	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C803/C803M	(2018) Standard Test Method for Penetration Resistance of Hardened Concrete
ASTM C873/C873M	(2015) Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
ASTM C900	(2015) Standard Test Method for Pullout Strength of Hardened Concrete
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1074	(2019) Standard Practice for Estimating Concrete Strength by the Maturity Method
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1116/C1116M	(2010a; R 2015) Standard Specification for Fiber-Reinforced Concrete



ASTM C1240	(2020) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1260	(2021) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1567	(2021) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1778	(2016) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2628	(1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2835	(1989; R 2017) Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D5759	(2012; R 2020) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E96/E96M	(2022) Standard Test Methods for

Gravimetric Determination of Water Vapor  
Transmission Rate of Materials

- ASTM E329 (2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
- ASTM E1155 (2020) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
- ASTM E1643 (2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
- ASTM E1745 (2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

## CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

- CRSI 10MSP (2018) Manual of Standard Practice
- CRSI RB4.1 (2016) Supports for Reinforcement Used in Concrete

## FOREST STEWARDSHIP COUNCIL (FSC)

- FSC STD 01 001 (2015) Principles and Criteria for Forest Stewardship

## NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

- NIST PS 1 (2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood

## U.S. ARMY CORPS OF ENGINEERS (USACE)

- COE CRD-C 104 (1980) Method of Calculation of the Fineness Modulus of Aggregate
- COE CRD-C 513 (1974) Corps of Engineers Specifications for Rubber Waterstops
- COE CRD-C 572 (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

## 1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, slag cement, and silica fume.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids

that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.

- d. "Supplementary cementing materials" (SCM) include coal fly ash, silica fume, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.
- e. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.
- f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.
- g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.
- h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.
- i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.
- j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Quality Control Plan; G

Quality Control Personnel Certifications; G

Quality Control Organizational Chart

Laboratory Accreditation; G

Maturity Method Data

#### SD-02 Shop Drawings

Reinforcing Steel; G

SD-03 Product Data

Joint Sealants

Joint Filler

Formwork Materials

Recycled Aggregate Materials

Cementitious Materials

Vapor Retarder and Vapor Barrier

Concrete Curing Materials

Reinforcement

Liquid Chemical Floor Hardeners and Sealers

Admixtures

Reinforcing Fibers

Mechanical Reinforcing Bar Connectors

Waterstops

Local/Regional Materials

Biodegradable Form Release Agent

Pumping Concrete

Finishing Plan

Nonshrink Grout

SD-04 Samples

Slab Finish Sample

Surface Finish Samples

SD-05 Design Data

Concrete Mix Design; G

a. Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, silica fume, synthetic fiber reinforcement, and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which produce a range of strength encompassing those required for each class and type of concrete required. If source material changes, resubmit mix

proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submit copies of the fly ash, silica fume, synthetic fiber reinforcement and pozzolan test results, in addition. The approval of fly ash, silica fume, and pozzolan and synthetic fiber reinforcement test results must be within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

#### SD-06 Test Reports

Concrete Mix Design; G

Fly Ash

Pozzolan

Slag Cement

Aggregates

Fiber-Reinforced Concrete; G

Tolerance Report

Compressive Strength Tests; G

Unit Weight of Structural Concrete

Chloride Ion Concentration

Air Content

Slump Tests

Water

#### SD-07 Certificates

Reinforcing Bars

Welder Qualifications

Silica Fume Manufacturer's Representative

VOC Content for Form Release Agents, Curing Compounds, and Concrete Penetrating Sealers

Safety Data Sheets

Forest Stewardship Council (FSC) Certification

Field Testing Technician and Testing Agency

#### SD-08 Manufacturer's Instructions

## Liquid Chemical Floor Hardeners and Sealers

### Joint Sealants

### Curing Compound

#### 1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Follow [ACI 301](#), [ACI 304R](#) and [ASTM A934/A934M](#) requirements and recommendations. Do not deliver concrete until vapor retarder, vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

##### 1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

##### 1.5.1.1 Epoxy Coated Reinforcing Steel

Record coating lot on each shipping notice and carefully identify and re-tag bar bundles from bending plant. Provide systems for handling coated bars which have padded contact areas such as, nylon slings, all free of dirt and grit. Lift bundled coated bars with strong back, multiple supports, or platform bridge to prevent sagging and abrasion. Pad bundling bands where in contact with bars. Do not drop or drag bars or bundles. Store coated bars both in shop and in field, aboveground, on wooden or padded cribbing. Space the dunnage close enough to prevent excessive sags. Stack large quantities of straight bars with adequate protective blocking between layers. Schedule deliveries of epoxy coated bars to the job site to avoid the need for long term storage. Protect from direct sunlight and weather. Cover bars to be stored longer than 12 hours at the job site with opaque polyethylene sheeting or other suitable equivalent protective material.

#### 1.6 QUALITY ASSURANCE

##### 1.6.1 Design Data

##### 1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, fibers, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide

documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. Required average strength can be documented by field experience if field strength test data are available and represent a single group of at least 10 consecutive strength tests for one mixture, using materials and conditions similar to those expected for work, and encompassing a period of not less than 45 days. The average of field strength tests shall equal or exceed fcr'. Changes in materials, conditions, and proportions within the test record shall not have been more closely restricted than those for the proposed work. Test records shall not be more than 24 months old. Obtain mix design approval from the contracting officer prior to concrete placement.

#### 1.6.2 Shop Drawings

##### 1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

#### 1.6.3 Control Submittals

##### 1.6.3.1 Pumping Concrete

Submit proposed materials and methods for pumping concrete. Submittal must include mix designs, pumping equipment including type of pump and size and material for pipe, and maximum length and height concrete is to be pumped.

##### 1.6.3.2 Silica Fume Manufacturer's Representative

The manufacturer's representative must be present at mix plant to ensure proper mix, including high range water reducer, and batching methods during the first 3 days of concrete mix preparation and placement. After which the manufacturer's representative must designate a representative at the concrete producer's plant to ensure the concrete mix procedures meet the silica fume manufacturer's recommendations.

##### 1.6.3.3 VOC Content for form release agents, curing compounds, and concrete penetrating sealers

Submit certification for the form release agent, curing compounds, and concrete penetrating sealers that indicate the VOC content of each product.

##### 1.6.3.4 Safety Data Sheets

Submit Safety Data Sheets (SDS) for all materials that are regulated for hazardous health effects. SDS must be readily accessible during each work

shift to employees when they are at the construction site.

#### 1.6.4 Test Reports

##### 1.6.4.1 Fly Ash and Pozzolan

Submit test results in accordance with [ASTM C618](#) for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

##### 1.6.4.2 Slag Cement

Submit test results in accordance with [ASTM C989/C989M](#) for slag cement. Submit test results performed within 6 months of submittal date.

##### 1.6.4.3 Aggregates

Submit test results in accordance with [ASTM C33/C33M](#), or [ASTM C330/C330M](#) for lightweight aggregate, and [ASTM C1293](#) or [ASTM C1567](#) as required in the paragraph titled ALKALI-AGGREGATE REACTION.

##### 1.6.4.4 Fiber-Reinforced Concrete

Test to determine flexural toughness index I5 in accordance with [ASTM C1116/C1116M](#).

#### 1.6.5 Field Samples

##### 1.6.5.1 Slab Finish Sample

Install minimum of 10 foot by 10 foot slab. Slab finish sample must not be part of the final project. Finish as required by specification.

##### 1.6.5.2 Surface Finish Samples

Provide a minimum of three sample concrete panels for each finish for each mix design, 3 feet by 3 feet, 3 inches thick. Use the approved concrete mix design(s). Provide sample panels on-site at locations directed. Once approved, each set of panels must be representative of each of the finishes specified and of the workmanship and finish(es) required. Do not remove or destroy samples until directed by the Contracting Officer.

##### 1.6.6 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of [ACI 121R](#) and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of [ACI SP-15](#) and [CRSI 10MSP](#) at project site.

##### 1.6.7 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a [quality control organizational chart](#) defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.



Submit American Concrete Institute certification for the following:

- a. CQC personnel responsible for inspection of concrete operations.
- b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
- c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

#### 1.6.7.1 Quality Manager Qualifications

The quality manager must hold a current license as a professional engineer in a U.S. state or territory with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

#### 1.6.7.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

- a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with [ACI SP-2](#) or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in [ACI SP-2](#).
- b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of [ASTM E329](#).
- c. Testing agencies that perform testing services on concrete materials must meet the requirements of [ASTM C1077](#).

#### 1.6.8 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of [ASTM C1077](#) and be Cement and Concrete Reference Laboratory (CCRL) inspected.

#### 1.6.9 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with [ASTM C1077](#), including [ASTM C78/C78M](#) and [ASTM C1260](#). The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

- a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials who is competent in concrete materials and must sign all reports and designs.
- b. Acceptance Testing: Furnish all materials, labor, and facilities

required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by [ASTM C31/C31M](#).

- c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to material manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing period or for 72 hours after installation:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 84 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

##### 1.7.1 Submittals for Environmental Performance

- a. Provide data indication the percentage of post-industrial pozzolan (fly ash, slag cement) cement substitution as a percentage of the full product composite by weight.
- b. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.
- c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.
- d. Provide product data stating the location where all products were manufactured
- e. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.
- f. For projects using reusable formwork, provide data showing how formwork is reused.
- g. Provide SDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.
- h. Provide SDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

#### 1.8 SUSTAINABLE DESIGN REQUIREMENTS

##### 1.8.1 [Local/Regional Materials](#)

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources. See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total local material requirements.

#### 1.8.2 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

#### 1.9 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with AWS D1.4/D1.4M.

Verify that Welder qualifications are in accordance with AWS D1.4/D1.4M for welding of reinforcement or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

### PART 2 PRODUCTS

#### 2.1 FORMWORK MATERIALS

- a. Form-facing material in contact with concrete must be lumber, plywood, tempered concrete-form-grade hardboard, metal, plastic,. Submit product information on proposed form-facing materials if different from that specified herein.
- b. Design formwork, shores, reshores, and backshores to support loads transmitted to them and to comply with applicable building code requirements.
- c. Design formwork and shoring for load redistribution resulting from stressing of post-tensioned reinforcement. Ensure that formwork allows movement resulting from application of prestressing force.
- d. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.
- e. Design formwork to accommodate waterstop materials in joints at locations indicated in Contract Documents.
- f. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.
- g. Design formwork joints to inhibit leakage of mortar.
- h. Limit deflection of facing materials for concrete surfaces exposed to view to 1/240 of center-to-center spacing of facing supports.

##### 2.1.1 Wood Forms

Use lumber as specified in Section 06 10 00 ROUGH CARPENTRY and as

follows. Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with [NIST PS 1](#), B-B concrete form panels or better or [AHA A135.4](#), hardboard for smooth form lining.

#### 2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to [NIST PS 1](#), B-B, concrete form, not less than [5/8-inch](#) thick.

#### 2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to [NIST PS 1](#), B-B, high density form overlay, not less than [5/8-inch](#) thick.

#### 2.1.2 Plastic Forms

Plastic lumber as specified in Section [06 10 00](#) ROUGH CARPENTRY.

#### 2.1.3 Carton Forms

Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete until initial set.

#### 2.1.4 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

### 2.2 FORMWORK ACCESSORIES

- a. Use commercially manufactured formwork accessories, including ties and hangers.
- b. Form ties and accessories must not reduce the effective cover of the reinforcement.

#### 2.2.1 Form Ties

- a. Use form ties with ends or end fasteners that can be removed without damage to concrete.
- b. Where indicated in Contract Documents, use form ties with integral water barrier plates or other acceptable positive water barriers in walls.
- c. The breakback distance for ferrous ties must be at least [2 in.](#) for Surface Finish-2.0 or Surface Finish-3.0, as defined in [ACI 301](#).
- d. Submit manufacturer's data sheet on form ties.

#### 2.2.2 Waterstops

Submit manufacturer's data sheet on waterstop materials and splices.

##### 2.2.2.1 PVC Waterstop

Polyvinylchloride waterstops must conform to [COE CRD-C 572](#).

#### 2.2.2.2 Rubber Waterstop

Rubber waterstops must conform to [COE CRD-C 513](#).

#### 2.2.2.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops must conform to [ASTM D471](#).

#### 2.2.2.4 Hydrophilic Waterstop

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water must conform to the following requirements when tested in accordance to [ASTM D412](#): Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness must be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F must be 3 to 1 minimum.

#### 2.2.3 Biodegradable Form Release Agent

- a. Provide form release agent that is colorless, biodegradable, and water-based, with a zero VOC content.
- b. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
- c. Provide form release agent that reduces formwork moisture absorption, and does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene. Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.
- d. Submit manufacturer's product data on formwork release agent for use on each form-facing material.

#### 2.2.4 Chamfer Materials

Use lumber materials with dimensions of  $3/4 \times 3/4$  in.

#### 2.2.5 Construction and movement joints

- a. Submit details and locations of construction joints in accordance with the requirements herein.
- b. Locate construction joints within middle one-third of spans of slabs, beams, and girders. If a beam intersects a girder within the middle one-third of girder span, the distance between the construction joint in the girder and the edge of the beam must be at least twice the width of the larger member.
- c. For members with post-tensioning tendons, locate construction joints where tendons pass through centroid of concrete section.
- d. Locate construction joints in walls and columns at underside of slabs, beams, or girders and at tops of footings or slabs.
- e. Make construction joints perpendicular to main reinforcement.

- f. Provide movement joints where indicated in Contract Documents or in accepted alternate locations.
- g. Submit location and detail of movement joints if different from those indicated in Contract Documents.
- h. Submit manufacturer's data sheet on expansion joint materials.
- i. Provide keyways where indicated in Contract Documents.

#### 2.2.6 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

### 2.3 CONCRETE MATERIALS

#### 2.3.1 Cementitious Materials

##### 2.3.1.1 Portland Cement

- a. Unless otherwise specified, provide cement that conforms to [ASTM C150/C150M](#) Type I, II, III, IV or V.
- b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- c. For portland cement manufactured in a kiln fueled by hazardous waste, maintain a record of source for each batch. Supplier must certify that no hazardous waste is used in the fuel mix or raw materials. Supplier must certify that the hazardous waste is neutralized by the manufacturing process and that no additional pollutants are discharged.
- d. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.
- e. Cementitious materials must be stored and kept dry and free from contaminants.

##### 2.3.1.2 Fly Ash

- a. [ASTM C618](#), Class F or Class C, except that the maximum allowable loss on ignition must not exceed 6 percent.
- b. If fly ash is used it shall range from 15 to 20 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, it shall not be used. Report the chemical analysis of the fly ash in accordance with [ASTM C311/C311M](#). Evaluate and classify fly ash in accordance with [ASTM D5759](#).

##### 2.3.1.3 Silica Fume

Silica fume must conform to [ASTM C1240](#), including the optional limits on reactivity with cement alkalis. Silica fume may be furnished as a dry,

densified material or as slurry. Proper mixing is essential to accomplish proper distribution of the silica fume and avoid agglomerated silica fume which can react with the alkali in the cement resulting in premature and extensive concrete damage. Supervision at the batch plant, finishing, and curing is essential. Provide at the Contractor's expense the services of a manufacturer's technical representative, experienced in mixing, proportioning, placement procedures, and curing of concrete containing silica fume. This representative must be present on the project prior to and during at least the first 4 days of concrete production and placement using silica fume. A High Range Water Reducing admixture (HRWRA) must be used with silica fume.

#### 2.3.1.4 Other Supplementary Cementitious Materials

Natural pozzolan must be raw or calcined and conform to [ASTM C618](#), Class N, including the optional requirement for uniformity.

Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to [ASTM C618](#), Class F or N, and the following additional requirements:

- a. The strength activity index at 28 days of age must be at least 95 percent of the control specimens.
- b. The average particle size must not exceed 6 microns.
- c. The sum of  $SiO_2 + Al_2O_3 + Fe_2O_3$  must be greater than 77 percent.

#### 2.3.2 Water

- a. Water or ice must comply with the requirements of [ASTM C1602/C1602M](#).
- b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.
- c. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.
- d. Protect mixing water and ice from contamination during storage and delivery.
- e. Submit test report showing water complies with [ASTM C1602/C1602M](#).

#### 2.3.3 Aggregate

##### 2.3.3.1 Normal-Weight Aggregate

- a. Aggregates must conform to [ASTM C33/C33M](#).
- b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.
- c. Provide sand that is at least 50 percent natural sand.
- d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely.

Do not use aggregates that contain frozen lumps.

- e. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with [ASTM C33/C33M](#), and [ASTM C1293](#) expansion data not more than 18 months old.

#### 2.3.3.2 Lightweight Aggregate

Lightweight aggregate in accordance with [ASTM C330/C330M](#).

#### 2.3.3.3 Recycled Aggregate Materials

Use a minimum of 25 percent recycled aggregate, depending on local availability and conforming to requirements of the mix design. Recycled aggregate to include: recovered concrete and recovered stone that meets the aggregate requirements specified. Submit recycled material request with the aggregate certification submittals and do not use until approved by the Contracting Officer.

#### 2.3.4 Admixtures

- a. Chemical admixtures must conform to [ASTM C494/C494M](#).
- b. Air-entraining admixtures must conform to [ASTM C260/C260M](#).
- c. Chemical admixtures for use in producing flowing concrete must conform to [ASTM C1017/C1017M](#).
- d. Do not use calcium chloride admixtures.
- e. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.
- f. Protect stored admixtures against contamination, evaporation, or damage.
- g. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.
- h. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

### 2.4 MISCELLANEOUS MATERIALS

#### 2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with [ACI 301](#) Section 5 and [ACI 308.1](#) Section 2. Submit product data for concrete curing compounds. Submit manufacturer's instructions for placement of curing compound.

#### 2.4.2 Nonshrink Grout

Nonshrink grout in accordance with [ASTM C1107/C1107M](#).

#### 2.4.3 Floor Finish Materials



#### 2.4.3.1 Liquid Chemical Floor Hardeners and Sealers

- a. Hardener must be a colorless aqueous solution containing a blend of inorganic silicate or silicate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufacturer's instructions for placement of liquid chemical floor hardener.
- b. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufacturer's instructions for placement of sealers.

#### 2.4.3.2 Abrasive Aggregate for Nonslip Aggregate Finish

Aggregate must be packaged, factory-graded fused aluminum oxide grits, or it may be crushed emery containing not less than 40-percent aluminum oxide and not less than 25-percent ferric oxide. Aggregate must be rust proof and nonglazing and must be unaffected by freezing, moisture, and cleaning materials.

#### ]2.4.3.3 Dry Materials for Colored Wear-Resistant Finish

Provide materials that are packaged, dry, and a combination of materials formulated for producing colored and wear-resistant monolithic surface treatments; they must include portland cement, graded-quartz aggregate, coloring pigments, and dispersing agents. Provide coloring pigments that are finely ground, nonfacing mineral oxides prepared especially for the purpose and interground with the cement.

#### 2.4.3.4 Aggregate for Heavy-Duty Wear-Resistant Finish

Provide aggregate that is traprock or emery, as follows:

Traprock must be packaged, crushed, natural, fine-to-medium-grained, igneous rock, such as diabase, basalt, or black granite. Traprock aggregate must be well-graded in size from particles retained on No. 4 sieve 0.187 inch to particles passing 3/8-inch sieve.

Emery must be packaged, factory-graded, crushed, natural-emery ore, cubical or polyhedral in form, containing not less than 35-percent aluminum oxide and not less than 24-percent ferric oxide. Emery aggregate must be well graded in size from particles retained on No. 50 sieve 0.0118 inch to particles passing No. 8 sieve 0.0929 inch.

Provide iron aggregate, as follows:

Iron must be packaged, ground and graded cubicle iron particles with dispersing agents, formulated to blend with portland cement for producing wear-resistant monolithic surface treatments. Provide aggregate that is free of nonferrous metals, oil, grease, soluble alkaline compounds, rust, and impurities and must be well-graded in size from particles retained on No. 50 sieve 0.0118 inch to particles passing No. 8 sieve 0.0929 inch.

#### 2.4.3.5 Aggregate for Heavy-Duty Floor Topping

Provide emery (or may be traprock or traprock-screenings) fine aggregates, as specified.

Provide emery that is packaged, factory-graded, crushed natural emery ore

containing not less than 35-percent aluminum oxide and not less than 24-percent ferric oxide. Provide aggregate that is cubical or polyhedral in form and does not change its physical or chemical nature in the presence of moisture. Grade aggregate to a fineness modulus of 3.9 to 4.0, with 100 percent passing 3/8-inch sieve and not less than 95 percent retained on No. 100 sieve. Deliver emery in moisture-resistant bags.

Provide traprock that is packaged, crushed, natural, fine- to medium-grained igneous rock such as diabase, basalt, or black granite. Uniformly grade coarse aggregate with 100 percent passing 1/2-inch sieve, 30 to 50 percent passing 3/8-inch sieve, 0 to 15 percent passing No. 4 sieve, and 0 to 5 percent passing No. 8 sieve.

Provide fine aggregate using traprock that conforms to ASTM C33/C33M, except gradation. Grade fine aggregate within the following limits:

SIEVE	PERCENT PASSING
3/8 in.	100
No. 4	95 to 100
No. 8	65 to 80
No. 16	45 to 65
No. 30	25 to 45
No. 50	5 to 15
No. 100	0 to 5

Deliver traprock coarse aggregate and fine aggregate in moisture-resistant bags.

#### 2.4.4 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 cork or 100% post-consumer paper meeting ASTM D 1752(subparagraphs 5.1 to 5.4). Material must be 1/2 inch thick, unless otherwise indicated.

#### 2.4.5 Joint Sealants

Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufacturer's product data, indicating VOC content.

##### 2.4.5.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T. ASTM D 7116 for surfaces subjected to jet fuel.

##### 2.4.5.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T.

##### 2.4.5.3 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

##### 2.4.5.4 Lubricant for Preformed Compression Seals

ASTM D2835.

#### 2.4.6 Vapor Retarder and Vapor Barrier

ASTM E1745 Class A polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

#### 2.4.7 Dovetail Anchor Slot

Preformed metal slot approximately 1 inch by 1 inch of not less than 22 gage galvanized steel cast in concrete. Coordinate actual size and throat opening with dovetail anchors and provide with removable filler material.

### 2.5 CONCRETE MIX DESIGN

#### 2.5.1 Properties and Requirements

- a. Use materials and material combinations listed in this section and the contract documents.
- b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

The minimum cementitious material content for concrete used in floors must meet the following requirements:

Nominal maximum size of aggregate, in.	Minimum cementitious material content, pounds per cubic yard
1-1/2	470
1	520
3/4	540
3/8	610

- c. Selected target slump must meet the requirements this section, the contract documents, and must not exceed 4 in. Concrete must not show visible signs of segregation.
- d. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117.
- e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.
- f. Concrete must be air entrained for members assigned to Exposure Class

F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.

- g. Measure air content at the point of delivery in accordance with [ASTM C173/C173M](#) or [ASTM C231/C231M](#).
- h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.

2.5.2 Durability

2.5.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

- a. For each aggregate used in concrete, the expansion result determined in accordance with [ASTM C1293](#) must not exceed 0.04 percent at one year.
- b. For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with [ASTM C1567](#) must not exceed 0.10 percent at an age of 16 days.
- c. Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Reactivity must be determined by testing in accordance with [ASTM C1293](#) and categorized in accordance with [ASTM C1778](#). Alkali content is calculated as follows:  

$$LBA = (\text{cement content, pounds per cubic yard}) \times (\text{equivalent alkali content of portland cement in percent}/100 \text{ percent})$$

2.5.2.2 Concrete Temperature

The temperature of concrete as delivered must not exceed 95°F.

2.5.2.3 Concrete permeability

- a. Provide concrete meeting the requirements of the following table based on exposure class assigned to members requiring low permeability in the Contract Documents.

Exposure class	Maximum w/cm*	Minimum f'c, psi	Additional minimum requirements
W0	N/A	2500	None
W1	0.5	4000	None

\*The maximum w/cm limits do not apply to lightweight concrete.

- b. Submit documentation verifying compliance with specified requirements.

### 2.5.3 Trial Mixtures

Trial mixtures must be in accordance to [ACI 301](#).

### 2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of [ASTM C94/C94M](#).

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by [ASTM C94/C94M](#):

- a. Type and brand cement
- b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixtures
- e. Total water content expressed by water cementitious material ratio

## 2.6 REINFORCEMENT

- a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of [ACI 117](#).
- b. Submit manufacturer's certified test report for reinforcement.
- c. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.
- d. Submit request with locations and details of splices not indicated in Contract Documents.
- e. Submit request to place column dowels without using templates.
- f. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

### 2.6.1 Reinforcing Bars

- a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.
- b. [ASTM A615/A615M](#) with the bars marked S, Grade 60; or [ASTM A996/A996M](#) with the bars marked R, Grade 60, or marked A, Grade 60. Cold drawn wire used for spiral reinforcement must conform to [ASTM A1064/A1064M](#). See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total recycled content requirements.
- c. Reinforcing bars may contain post-consumer or post-industrial recycled content.
- d. Submit mill certificates for reinforcing bars.

#### 2.6.1.1 Galvanized Reinforcing Bars

- a. Provide zinc-coated (galvanized) reinforcing bars that conform to [ASTM A767/A767M](#), Class 2 as required by the contract Documents or [ASTM A1094/A1094M](#).
- b. Coating damage incurred during shipment, handling, and placing of zinc-coated (galvanized) reinforcing bars must be repaired in accordance with [ASTM A780/A780M](#). Damaged areas must not exceed 2 percent of surface area in each linear foot of each bar or bar must not be used. The 2 percent limit on maximum allowed damaged coating area must include previously repaired areas damaged before shipment as required by [ASTM A767/A767M](#).

#### 2.6.1.2 Epoxy-Coated Reinforcing Bars

- a. Provide epoxy-coated reinforcing bars that conform to [ASTM A775/A775M](#), Grade 60.
- b. Coatings must be applied in plants that are certified in accordance with Concrete Reinforcing Steel Institute (CRSI) Epoxy Coating Plant Certification Program or an equivalent program acceptable to the contracting officer.
- c. Coating damage incurred during shipment, storage, handling, and placing of epoxy-coated reinforcing bars must be repaired. Repair damaged coating areas with patching material conforming to [ASTM A775/A775M](#) or [ASTM A934/A934M](#) as applicable and in accordance with material manufacturer's written recommendations. Damaged coating area must not exceed 2 percent of surface area in each linear foot of each bar or bar must not be used. The 2 percent limit on damaged coating area must include repaired areas damaged before shipment as required by [ASTM A775/A775M](#) or [ASTM A934/A934M](#) as applicable. Fading of coating color shall not be cause for rejection of epoxy-coated reinforcing bars.
- d. Submit concrete Reinforcing Steel Institute (CRSI) Epoxy Coating Plant Certification.
- e. Epoxy coated reinforcing bars shall be handled and stored in accordance with [ASTM A775/A775M](#). If the manufacturer stores bars outdoors for more than 2 months, cover coated reinforcement with opaque protective material.

#### 2.6.1.3 Dual-coated Reinforcing Bars

- a. Zinc and epoxy dual-coated reinforcing bars must conform to [ASTM A1055/A1055M](#)
- b. Coating damage incurred during shipment, storage, handling, and placing of zinc and epoxy dual-coated reinforcing bars must be repaired. Repair damaged coating areas with patching material conforming to [ASTM A1055/A1055M](#) and in accordance with material manufacturer's written recommendations. Damaged coating area must not exceed 2 percent of surface area in each linear foot of each bar or bar must not be used. The 2 percent limit on damaged coating area must include repaired areas damaged before shipment as required by [ASTM A1055/A1055M](#). Fading of coating color shall not be cause for rejection of zinc and epoxy dual-coated reinforcing bars.

#### 2.6.1.4 Stainless Steel Reinforcing Bars

Stainless steel bars must meet the requirements of [ASTM A955/A955M](#).

#### 2.6.1.5 Headed Reinforcing Bars

Headed reinforcing bars must conform to [ASTM A970/A970M](#) including Annex A1, and other specified requirements.

#### 2.6.1.6 Bar Mats

- a. Bar mats must conform to [ASTM A184/A184M](#).
- b. If coated bar mats are required, repair damaged coating as required in the paragraph titled GALVANIZED REINFORCING BARS EPOXY-COATED REINFORCING BARS and DUAL-COATED REINFORCING BARS.

#### 2.6.1.7 Headed Shear Stud Reinforcement

Headed studs and headed stud assemblies must conform to [ASTM A1044/A1044M](#).

#### 2.6.2 Mechanical Reinforcing Bar Connectors

- a. Provide 125 percent minimum yield strength of the reinforcement bar.
- b. Mechanical splices for galvanized reinforcing bars must be galvanized or coated with dielectric material.
- c. Mechanical splices used with epoxy-coated or dual-coated reinforcing bars must be coated with dielectric material.
- d. Submit data on mechanical splices demonstrating compliance with this paragraph.

#### 2.6.3 Wire

- a. Provide flat sheets of welded wire reinforcement for slabs and toppings.
- b. Plain or deformed steel wire must conform to [ASTM A1064/A1064M](#).
- c. Stainless steel wire must conform to [ASTM A1022/A1022M](#).
- d. Epoxy-coated wire must conform to [ASTM A884/A884M](#). Coating damage incurred during shipment, storage, handling, and placing of epoxy-coated wires must be repaired. Repair damaged coating areas with patching material in accordance with material manufacturer's written recommendations. If damaged area exceeds 2 percent of surface area in each linear foot of each wire, wire must not be used. The 2 percent limit on damaged coating area must include repaired areas damaged before shipment as required by [ASTM A884/A884M](#). Fading of coating color shall not be cause for rejection of epoxy-coated wire reinforcement.

#### 2.6.4 Welded wire reinforcement

- a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.
- b. Plain welded wire reinforcement must conform to [ASTM A1064/A1064M](#), with

welded intersections spaced no greater than 12 in. apart in direction of principal reinforcement.

- c. Deformed welded wire reinforcement must conform to [ASTM A1064/A1064M](#), with welded intersections spaced no greater than 16 in. apart in direction of principal reinforcement.
- d. Epoxy-coated welded wire reinforcement must conform to [ASTM A884/A884M](#). Coating damage incurred during shipment, storage, handling, and placing of epoxy-coated welded wire reinforcement must be repaired in accordance with [ASTM A884/A884M](#). Repair damaged coating areas with patching material in accordance with material manufacturer's written recommendations. If damaged area exceeds 2 percent of surface area in each linear foot of each wire or welded wire reinforcement, the sheet containing the damaged area must not be used. The 2 percent limit on damaged coating area must include repaired areas damaged before shipment as required by [ASTM A884/A884M](#). Fading of coating color shall not be cause for rejection of epoxy-coated welded wire reinforcement.
- e. Stainless steel welded wire reinforcement must conform to [ASTM A1022/A1022M](#).
- f. Zinc-coated (galvanized) welded wire reinforcement must conform to [ASTM A1060/A1060M](#). Coating damage incurred during shipment, storage, handling, and placing of zinc-coated (galvanized) welded wire reinforcement must be repaired in accordance with [ASTM A780/A780M](#). If damaged area exceeds 2 percent of surface area in each linear foot of each wire or welded wire reinforcement, the sheet containing the damaged area must not be used. The 2 percent limit on damaged coating area shall include repaired areas damaged before shipment as required by [ASTM A1060/A1060M](#).

#### 2.6.5 Reinforcing Bar Supports

- a. Provide reinforcement support types within structure as required by Contract Documents. Reinforcement supports must conform to [CRSI RB4.1](#). Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with [CRSI RB4.1](#).
- b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar support. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer coated wire bar supports.
- c. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.
- d. See Section [01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING](#) for cumulative total recycled content requirements. Plastic and steel may contain post-consumer or post-industrial recycled content.

#### 2.6.6 Reinforcing Fibers

##### 2.6.6.1 Synthetic Fibers

In addition to the requirements specified above, provide fiber reinforced concrete in accordance with [ASTM C1116/C1116M](#) Type III, synthetic fiber reinforced concrete, and as follows. Synthetic reinforcing fibers must be 100 percent virgin monofilament polypropylene fibers. See Section [01 33 29](#)



SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total recycled content requirements. Fibers may contain post-consumer or post-industrial recycled content.

Provide fibers that have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. Add fibers at the batch plant.

#### 2.6.6.2 Steel Fibers

If steel fiber-reinforced concrete is specified in Contract Documents for providing shear resistance, steel fibers must be deformed and conform to ASTM A820/A820M. Steel fibers must have a length-to-diameter ratio of at least 50 and not exceed 100.

#### 2.6.7 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to ASTM A615/A615M, Grade 40. Provide dowel pipe that is steel conforming to ASTM A53/A53M.

#### ]2.6.8 Welding

- a. Provide weldable reinforcing bars that conform to ASTM A706/A706M and ASTM A615/A615M and Supplement S1, Grade 60, except that the maximum carbon content must be 0.55 percent.
- b. Comply with AWS D1.4/D1.4M unless otherwise specified. Do not tack weld reinforcing bars.
- c. Welded assemblies of steel reinforcement produced under factory conditions, such as welded wire reinforcement, bar mats, and deformed bar anchors, are allowed.
- d. After completing welds on zinc-coated (galvanized), epoxy-coated, or zinc and epoxy dual-coated reinforcement, coat welds and repair coating damage as previously specified.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.
- b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.
- c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

#### 3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

#### 3.2.1 General

- a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.
- b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

#### 3.2.2 Subgrade Under Foundations and Footings

- a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.
- b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

#### 3.2.3 Subgrade Under Slabs on Ground

- a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.
- b. Previously constructed subgrade or fill must be cleaned of foreign materials
- c. Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of  $1/4$  inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.
- d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

#### 3.2.4 Edge Forms and Screed Strips for Slabs

- a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.
- b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

#### 3.2.5 Reinforcement and Other Embedded Items

- a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.
- b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a

combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

### 3.3 FORMS

- a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.
- b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.
- c. Provide formwork with clean-out openings to permit inspection and removal of debris.
- d. Inspect formwork and remove foreign material before concrete is placed.
- e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.
- f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.
- g. Fasten form wedges in place after final adjustment of forms and before concrete placement.
- h. Provide anchoring and bracing to control upward and lateral movement of formwork system.
- i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.
- j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.
- k. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.
- l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

#### 3.3.1 Coating

- a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.
- b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to

concrete placement.

- c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

#### 3.3.2 Reshoring

- a. Do not allow structural members to be loaded with combined dead and construction loads in excess of loads indicated in the accepted procedure.
- b. Install and remove reshores or backshores in accordance with accepted procedure.
- c. For floors supporting shores under newly placed concrete, either leave original supporting shores in place, or install reshores or backshores. Shoring system and supporting slabs must resist anticipated loads. Locate reshores and backshores directly under a shore position or as indicated on formwork shop drawings.
- d. In multistory buildings, place reshoring or backshoring over a sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads.

#### 3.3.3 Reuse

- a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.
- b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.
- c. Remove leaked mortar from formwork joints before reuse.

#### 3.3.4 Forms for Standard Rough Form Finish

Provide formwork in accordance with [ACI 301](#) Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

#### 3.3.5 Forms for Standard Smooth Form Finish

Provide formwork in accordance with [ACI 301](#) Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view.

#### 3.3.6 Form Ties

- a. For post-tensioned structures, do not remove formwork supports until stressing records have been accepted by the Contracting Officer.
- b. After ends or end fasteners of form ties have been removed, repair tie holes in accordance with [ACI 301](#) Section 5 requirements.

#### 3.3.7 Forms for Concrete Pan Joist Construction

Pan-form units for one-way or two-way concrete joist and slab construction must be factory-fabricated units of the approximate section indicated. Units must consist of steel or molded fiberglass concrete form pans.

Closure units must be furnished as required.

### 3.3.8 Tolerances for Form Construction

- a. Construct formwork so concrete surfaces conform to tolerances in [ACI 117](#).
- b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within [ACI 117](#) tolerances.
- c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

### 3.3.9 Removal of Forms and Supports

- a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.
- b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.
- c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.
- d. Leave formwork and shoring in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place required strength of concrete is reached.
- e. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

### 3.3.10 Strength of Concrete Required for Removal of Formwork

If removal of formwork, reshoring, or backshoring is based on concrete reaching a specified in-place strength, mold and field-cure cylinders in accordance with [ASTM C31/C31M](#). Test cylinders in accordance with [ASTM C39/C39M](#). Alternatively, use one or more of the methods listed herein to evaluate in-place concrete strength for formwork removal.

- a. Tests of cast-in-place cylinders in accordance with [ASTM C873/C873M](#). This option is limited to slabs with concrete depths from 5 to 12 in.
- b. Penetration resistance in accordance with [ASTM C803/C803M](#).
- c. Pullout strength in accordance with [ASTM C900](#).
- d. Maturity method in accordance with [ASTM C1074](#). Submit [maturity method data](#) using project materials and concrete mix proportions used on the

project to demonstrate the correlation between maturity and compressive strength of laboratory cured test specimens to the Contracting Officer.

### 3.4 WATERSTOP INSTALLATION AND SPLICES

- a. Provide waterstops in construction joints as indicated.
- b. Install formwork to accommodate waterstop materials. Locate waterstops in joints where indicated in Contract Documents. Minimize number of splices in waterstop. Splice waterstops in accordance with manufacturer's written instructions. Install factory-manufactured premolded mitered corners.
- c. Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Protect waterstops protruding from joints from damage.

#### 3.4.1 PVC Waterstop

Make splices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. Reform waterstops at splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, must show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

#### 3.4.2 Rubber Waterstop

Rubber waterstops must be spliced using cold bond adhesive as recommended by the manufacturer.

#### 3.4.3 Thermoplastic Elastomeric Rubber Waterstop

Fittings must be shop made using a machine specifically designed to mechanically weld the waterstop. A portable power saw must be used to miter or straight cut the ends to be joined to ensure good alignment and contact between joined surfaces. Maintain continuity of the characteristic features of the cross section of the waterstop (for example ribs, tabular center axis, and protrusions) across the splice.

#### 3.4.4 Hydrophilic Waterstop

Miter cut ends to be joined with sharp knife or shears. The ends must be adhered with adhesive.

### 3.5 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to [ACI 301](#). Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.
- b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

- c. Nonprestressed cast-in-place concrete members must have concrete cover for reinforcement given in the following table:

Concrete Exposure	Member	Reinforcement	Specified cover, in.
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	All	No. 6 through No. 18 bars	2
		No. 5 bar, W31 or D31 wire, and smaller	1-1/2
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars	1-1/2
		No. 11 bar and smaller	3/4
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	1-1/2

- d. Cast-in-place prestressed concrete members must have concrete cover for reinforcement, ducts, and end fittings given in the following table:

Concrete	Member	Reinforcement	Specified
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	Slabs, joists, and walls	All	1
	All other	All	1-1/2

Concrete	Member	Reinforcement	Specified
Not exposed to weather or in contact with ground	Slabs, joists, and walls	All	3/4
	Beams, columns, and tension ties	Primary reinforcement	1-1/2
		Stirrups, ties, spirals, and hoops	1

- e. Precast nonprestressed or prestressed concrete members manufactured under plant conditions must have concrete cover for reinforcement, ducts, and end fittings given in the following table:

Concrete Exposure	Member	Reinforcement	Specified cover, in.
Exposed to weather or in contact with ground	Walls	No. 14 and No. 18 bars; tendons larger than 1-1/2 in. diameter	1-1/2
		No. 11 bars and smaller; W31 and D31 wire, and smaller; tendons and strands 1-1/2 in.	3/4
	All other	No. 14 and No. 18 bars; tendons larger than 1-1/2 in.	2
		No. 6 through No. 11 bars; tendons and strands larger than 5/8 in. diameter through 1-1/2 in.	1-1/2
		No. 5 bar, W31 or D31 wire, and smaller; tendons and strands 5/8 in. diameter and smaller	1-1/4



Concrete Exposure	Member	Reinforcement	Specified cover, in.
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars; tendons larger than 1-1/2 in. diameter	1-1/4
		Tendons and strands 1-1/2 in. diameter and smaller	3/4
		No. 11 bar, W31 or D31	5/8
	Beams, columns, pedestals, and tension ties	Primary reinforcement	Greater of bar diameter and 5/8 and need not exceed 1-1/2
		Stirrups, ties, spirals, and hoops	3/8

### 3.5.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

### 3.5.2 Vapor Retarder and Vapor Barrier

- a. Install in accordance with [ASTM E1643](#). Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape.
- b. Remove torn, punctured, or damaged vapor retarder and vapor barrier material and provide with new vapor retarder and vapor barrier prior to placing concrete. Concrete placement must not damage vapor retarder and vapor barrier material. Place vapor barrier directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, a thin layer of approximately 1/2 inch of fine graded material should be rolled or compacted over the fill before installation of the vapor barrier to reduce the possibility of puncture. Control concrete placement so as to prevent damage to the vapor barrier.

### 3.5.3 Perimeter Insulation

Install perimeter insulation at locations indicated. Adhesive must be used

where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

#### 3.5.4 Reinforcement Supports

Provide reinforcement support in accordance with [CRSI RB4.1](#) and [ACI 301](#) Section 3 requirements. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least [2 inches](#) beyond the point of contact with the bars.

#### 3.5.5 Epoxy Coated Reinforcing

Epoxy Coated Reinforcing must meet the requirements of [ASTM A934/A934M](#) including Appendix X2, "Guidelines for Job Site Practices" except as otherwise specified herein.

##### 3.5.5.1 Epoxy Coated Reinforcing Steel Placement and Coating Repair

Carefully handle and install bars to minimize job site patching. Use the same precautions as described in the paragraph titled EPOXY-COATED REINFORCING BARS. Do not drag bars over other bars or over abrasive surfaces. Keep bar free of dirt and grit. When possible, assemble reinforcement as tied cages prior to final placement into the forms. Support assembled cages on padded supports. It is not expected that coated bars, when in final position ready for concrete placement, are completely free of damaged areas; however, excessive nicks and scrapes which expose steel is cause for rejection. Criteria for defects which require repair and for those that do not require repair are as indicated. Inspect for defects and provide required repairs prior to assembly. After assembly, reinspect and provide final repairs.

- a. Immediately prior to application of the patching material, manually remove any rust and debonded coating from the reinforcement by suitable techniques employing devices such as wire brushes and emery paper. Exercise care during this surface preparation so that the damaged areas are not enlarged more than necessary to accomplish the repair. Clean damaged areas of dirt, debris, oil, and similar materials prior to application of the patching material.
- b. Do repair and patching in accordance with the patching material manufacturer's recommendations. These recommendations, including cure times, must be available at the job site at all times.
- c. Allow adequate time for the patching materials to cure in accordance with the manufacturer's recommendation prior to concrete placement.

#### 3.5.6 Splicing

Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus [2 inches](#).

#### 3.5.7 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is

installed.

### 3.5.8 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

### 3.5.9 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

- a. Provide fabrication tolerances that are in accordance with [ACI 117](#).
- b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

### 3.5.10 Placing Reinforcement

Place reinforcement in accordance with [ACI 301](#).

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than [1 inch](#) from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not larger than [3-1/2 by 3-1/2 inches](#), and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

- a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with [ACI 301](#) and [CRSI 10MSP](#). Do not use supports to support runways for concrete conveying equipment and similar construction loads.
- b. Equip supports on ground and similar surfaces with sand-plates.
- c. Support welded wire reinforcement as required for reinforcing bars.
- d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than [16 gage](#).
- e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.
- f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

#### 3.5.11 Spacing of Reinforcing Bars

- a. Spacing must be as indicated in the Contract Documents.
- b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

#### 3.5.12 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

#### 3.5.13 Welding

Welding must be in accordance with [AWS D1.4/D1.4M](#).

### 3.6 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with [ASTM C94/C94M](#), [ACI 301](#), [ACI 302.1R](#) and [ACI 304R](#), except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

#### 3.6.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

### 3.6.2 Mixing

- a. Mix concrete in accordance with **ASTM C94/C94M**, **ACI 301** and **ACI 304R**.
- b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the concrete temperature is less than **84 degrees F**.
- c. Place concrete within 60 minutes if the concrete temperature is greater than **84 degrees F** except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.
- d. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture, within the manufacturer's recommended dosage, to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.
- e. When fibers are used, add fibers together with the aggregates and never as the first component in the mixer. Fibers must be dispensed into the mixing system using appropriate dispensing equipment and procedure as recommended by the manufacturer.

### 3.6.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

## 3.7 PLACING CONCRETE

Place concrete in accordance with **ACI 301** Section 5. Concrete shall be placed within 15 minutes of discharge into non-agitating equipment.

### 3.7.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of **4 inches** greater than indicated.

### 3.7.2 Pumping

**ACI 304R** and **ACI 304.2R**. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed **2 inches** at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point

of delivery to the pump and at the discharge end.

#### 3.7.2.1 Pumping Lightweight Concrete

In accordance with [ACI 213R](#) unless otherwise specified. Presoak or presaturate aggregates. Cement content must be minimum of [564 pounds per cubic yard](#) and be sufficient to accommodate a [4 to 6 inch](#) slump.

#### 3.7.3 Cold Weather

Cold weather concrete must meet the requirements of [ACI 306.1](#) unless otherwise specified. Do not allow concrete temperature to decrease below [50 degrees F](#). Obtain approval prior to placing concrete when the ambient temperature is below [40 degrees F](#) or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain [50 degrees F](#) minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to [37 degrees F](#) in any one hour and [50 degrees F](#) per 24 hours after heat application.

#### 3.7.4 Hot Weather

Hot weather concrete must meet the requirements of [ACI 305.1](#) unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in [ACI 305R](#) to prevent the evaporation rate from exceeding [0.2 pound of water per square foot](#) of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

#### 3.7.5 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

- a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.
- b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated

and covered with a cement grout coating.

- c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

### 3.8 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

#### 3.8.1 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

#### 3.8.2 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material. Return excess cement to supplier.

### 3.9 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

#### 3.9.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

#### 3.9.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

#### 3.9.3 Formed Surfaces

##### 3.9.3.1 Tolerances

Tolerances in accordance with ACI 117 and as indicated.

##### 3.9.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

##### 3.9.3.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

#### 3.9.4 Smooth-Rubbed, Grout-Cleaned Rubbed, Cork-Floated, or Exposed Aggregate Finishes

Provide finish per ACI 301 Section 5 in the locations indicated.

### 3.10 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Steel trowel and fine-broom finish concrete slabs that are to receive quarry tile,

ceramic tile, or paver tile. Where straightedge measurements are specified, Contractor must provide straightedge.

### 3.10.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Grate tampers ("jitterbugs") shall not be used.

#### 3.10.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. Finish concrete in accordance with [ACI 301](#) Section 5 for a scratched finish.

#### 3.10.1.2 Floated

Use for surfaces to receive roofing, waterproofing membranes, sand bed terrazzo, and exterior slabs where not otherwise specified. Finish concrete in accordance with [ACI 301](#) Section 5 for a floated finish.

#### 3.10.1.3 Concrete Containing Silica Fume

Finish using magnesium floats or darbies. Finish using techniques demonstrated in the sample installation.

#### 3.10.1.4 Steel Troweled

Use for floors intended as walking surfaces and for reception of floor coverings. Finish concrete in accordance with [ACI 301](#) Section 5 for a steel troweled finish.

#### 3.10.1.5 Nonslip Finish

Use on surfaces of exterior platforms, steps, and landings; and on exterior and interior pedestrian ramps. Finish concrete in accordance with [ACI 301](#) Section 5 for a dry-shake finish. After the selected material has been embedded by the two floatings, complete the operation with a broomed finish.

#### 3.10.1.6 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Perform a floated finish, then draw a broom or burlap belt across the surface to produce a coarse, scored texture. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab. Finish concrete in accordance with [ACI 301](#) Section 5 for a broomed finish.

#### 3.10.1.7 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by a burlap drag. Drag a strip of clean,



wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8 inch.

#### 3.10.1.8 Concrete Toppings Placement

The following requirements apply to the placement of toppings of concrete on base slabs that are either freshly placed and still plastic, or on hardened base slabs.

- a. Placing on a Fresh Base: Screed and bull float the base slab. As soon as the water sheen has disappeared, lightly rake the surface of the base slab with a stiff bristle broom to produce a bonding surface for the topping. Immediately spread the topping mixture evenly over the roughened base before final set takes place. Give the topping the finish specified herein.
- b. Bonding to a Hardened Base: When the topping is to be bonded to a floated or troweled hardened base, roughen the base by scarifying, grit-blasting, scabbling, planing, flame cleaning, or acid-etching to lightly expose aggregate and provide a bonding surface. Remove dirt, laitance, and loose aggregate by means of a stiff wire broom. Keep the clean base wet for a period of 12 hours preceding the application of the topping. Remove excess water and apply a 1:1:1/2 cement-sand-water grout, and brush into the surface of the base slab. Do not allow the cement grout to dry, and spread it only short distances ahead of the topping placement. Do not allow the temperature differential between the completed base and the topping mixture to exceed 41 degrees F at the time of placing. Place the topping and finish as specified herein.

#### 3.10.1.9 Chemical-Hardener Treatment

Apply liquid-chemical floor hardener where indicated after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat must be one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow to dry 24 hours between coats.

Approved proprietary chemical hardeners must be applied in accordance with manufacturer's printed directions.

#### 3.10.1.10 Colored Wear-Resistant Finish

- a. Give finish to monolithic slab surfaces where indicated.
- b. Apply dry shake materials for colored wear-resistant finish at the rate of 60 pounds per 100 square feet of surface.
- c. Immediately following first floating operation, approximately two-thirds of specified weight of dry shake material must be uniformly distributed over surface and embedded by means of power floating. After first dry-shake application has been embedded, uniformly distribute remainder of dry-shake material over surface at right angles to first dry-shake application and embed by means of power floating. Trueness of surface and other requirements for floating operations not specified in this paragraph must be as specified for float finish.
- d. After completion of float finish, apply a trowel finish as specified.

3.10.1.11 Heavy-Duty Wear-Resistant Finish

- a. Give finish to slab surfaces where indicated.
- b. Dry-shake material for heavy-duty, wear-resistant finish must consist of a mixture of standard portland cement and aggregate for heavy-duty, wear-resistant finish proportioned by weight as follows:

One part standard portland cement and two parts traprock aggregate for heavy-duty wear-resistant finish.

- c. Apply blended dry-shake material as follows:

Maximum type of aggregate in dry shake	Amount per 100 square feet of Surface
Traprock	160 pounds
Emery	130 pounds
Iron	130 pounds

- d. Immediately following the first floating operation, approximately one-half the specified weight of blended, uniformly distribute dry-shake materials over the surface and embedded by means of power floating. After the first dry-shake application has been embedded, uniformly distribute the remaining one-half of the blended dry-shake material over the surface at right angles to the first dry-shake application and embedded by means of power floating. Trueness of surface and other requirements for floating operations not specified in this paragraph must be as specified for float finish.
- e. After completion of the float finish, trowel finish the surface as specified.

3.10.2 Flat Floor Finishes

ACI 302.1R. Construct in accordance with one of the methods recommended in Table 10.15.3a, "Slab-on-ground flatness/levelness construction guide" or Table 10.15.3b, "Suspended slab flatness/levelness construction guide" appropriate for the type of construction. ACI 117 for tolerance tested by ASTM E1155.

- a. Specified Conventional Value:

Floor Flatness (Ff) Composite value 20, Local value 15 minimum  
 Floor Levelness (FL) Composite value 15, Local value 10 minimum

- b. Specified Industrial:

Floor Flatness (Ff) Composite value 30, Local value 15 minimum  
 Floor Levelness (FL) Composite value 20, Local value 10 minimum

3.10.2.1 Measurement of Floor Tolerances

Test slab within 24 hours of the final troweling. Provide tests to

Contracting Officer within 12 hours after collecting the data. Floor flatness inspector is required to provide a [tolerance report](#) which must include:

- a. Key plan showing location of data collected.
- b. Results required by [ASTM E1155](#).

#### 3.10.2.2 Remedies for Out of Tolerance Work

Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

#### 3.10.3 Concrete Walks

Provide [4 inches](#) thick minimum. Provide contraction joints spaced every [5 linear feet](#) unless otherwise indicated. Cut contraction joints [1 inch](#) deep, or one fourth the slab thickness whichever is deeper, with a jointing tool after the surface has been finished. Provide [0.5 inch](#) thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every [50 feet](#) maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to [1/4 inch in 5 feet](#).

#### 3.10.4 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

#### 3.10.5 Curbs and Gutters

Provide contraction joints spaced every [10 feet](#) maximum unless otherwise indicated. Cut contraction joints [3/4 inch](#) deep with a jointing tool after the surface has been finished. Provide expansion joints [1/2 inch](#) thick and spaced every [100 feet](#) maximum unless otherwise indicated. Perform pavement finish.

#### 3.10.6 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be [24 inches long, 12 inches wide and 4 inches thick](#), unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

### 3.11 JOINTS

#### 3.11.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

##### 3.11.1.1 Construction Joints for Constructability Purposes

- a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.
- b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.
- c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

#### 3.11.2 Isolation Joints in Slabs on Ground

- a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- b. Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

#### 3.11.3 Contraction Joints in Slabs on Ground

- a. Provide joints to form panels as indicated.
- b. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.
- c. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.
- d. Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.
- e. Sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

#### 3.11.4 Sealing Joints in Slabs on Ground

- a. Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound

to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

- b. Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

### 3.12 CONCRETE FLOOR TOPPING

#### 3.12.1 Standard Floor Topping

Provide topping for treads and platforms of metal steel stairs and elsewhere as indicated.

##### 3.12.1.1 Preparations Prior to Placing

- a. When topping is placed on a green concrete base slab, screed surface of base slab to a level not more than 1-1/2 inches nor less than 1 inch below required finish surface. Remove water and laitance from surface of base slab before placing topping mixture. As soon as water ceases to rise to surface of base slab, place topping.
- b. When topping is placed on a hardened concrete base slab, remove dirt, loose material, oil, grease, asphalt, paint, and other contaminants from base slab surface, leaving a clean surface. Prior to placing topping mixture, 2-1/2-inches minimum, slab surface must be dampened and left free of standing water. Immediately before topping mixture is placed, broom a coat of neat cement grout onto surface of slab. Do not allow cement grout to set or dry before topping is placed.
- c. When topping is placed on a metal surface, such as metal pans for steel stairs, remove dirt, loose material, oil, grease, asphalt, paint, and other contaminants from metal surface.

##### 3.12.1.2 Placing

Spread standard topping mixture evenly on previously prepared base slab or metal surface, brought to correct level with a straightedge, and struck off. Topping must be consolidated, floated, checked for trueness of surface, and refloated as specified for float finish.

##### 3.12.1.3 Finishing

Give trowel finish standard floor topping surfaces.

Give other finishes standard floor topping surfaces as indicated.

#### 3.12.2 Heavy-Duty Floor Topping

Provide topping where indicated.

##### 3.12.2.1 Heavy-duty Topping Mixture

Provide mixture that consists of 1 part portland cement and 2-1/2 parts emery aggregate or 1 part fine aggregate and 1-1/2 parts traprock coarse aggregate, by volume. Exact proportions of mixture must conform to recommendations of aggregate manufacturer. Mixing water must not exceed 3-1/4 gallons per 94-pound sack of cement including unabsorbed moisture in aggregate. Maximum slump must be 1 inch.

### 3.12.2.2 Base Slab

- a. Screed surface of slab to a level no more than 1-1/2 inches nor less than 1 inch below grade of finished floor.
- b. Give slab a scratch finish as specified.
- c. Preparations prior to placing.

Remove dirt, loose material, oil, grease, asphalt, paint and other contaminants from base slab surface. Prior to placing topping mixture, dampen slab surface and leave free of standing water. Immediately before topping mixture is placed, broom a coat of neat cement grout onto surface of slab. Allow cement grout to set or dry before topping mixture is placed.

### 3.12.2.3 Placing

Spread heavy-duty topping mixture evenly on previously prepared base slab, and bring to correct level with a straightedge, and strike off. Provide topping that is consolidated, floated, and checked for trueness of surface as specified for float finish, except that power-driven floats is the impact type.

### 3.12.2.4 Finishing

Give trowel finish heavy-duty floor topping surfaces. Provide trowel finish as specified, except that additional troweling after first power troweling must be not less than three hand-troweling operations.

## 3.13 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

### 3.13.1 Requirements for Type III, High-Early-Strength Portland Cement

The curing periods are required to be not less than one-fourth of those specified for portland cement, but in no case less than 72 hours.

### 3.13.2 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or

chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

### 3.13.3 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

### 3.13.4 Curing Unformed Surfaces

- a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.
- c. Accomplish final curing of concrete surfaces to receive liquid floor hardener of finish flooring by moisture-retaining cover curing.

### 3.13.5 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any one hour nor 80 degrees F in any 24-hour period.

### 3.13.6 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

### 3.13.7 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

## 3.14 FIELD QUALITY CONTROL

### 3.14.1 Aggregate Testing

#### 3.14.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with [ASTM C136/C136M](#) and [COE CRD-C 104](#) for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall be immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

#### 3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with [ASTM C136/C136M](#) for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

#### 3.14.2 Concrete Sampling

[ASTM C172/C172M](#). Collect samples of fresh concrete to perform tests specified. [ASTM C31/C31M](#) for making test specimens.

#### 3.14.3 Concrete Testing

##### 3.14.3.1 Slump Tests

[ASTM C143/C143M](#). Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

##### 3.14.3.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

##### 3.14.3.3 Compressive Strength Tests



**ASTM C39/C39M.** Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with **ASTM C31/C31M**, **ASTM C172/C172M** and applicable requirements of **ACI 305R** and **ACI 306R**. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. Take samples for strength tests of each mix design of concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of this section, the Contract Document, and **ACI 301**. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

#### 3.14.3.4 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

- a. Failure to meet compressive strength tests as evaluated.
- b. Reinforcement not conforming to requirements specified.
- c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
- d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.
- e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.
- f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

#### 3.14.3.5 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may

accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

#### 3.14.3.6 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with [ASTM C42/C42M](#), and as follows:

- a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.
- b. Test cores after moisture conditioning in accordance with [ASTM C42/C42M](#) if concrete they represent is more than superficially wet under service.
- c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.
- d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

#### 3.15 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

##### 3.15.1 Crack Repair

Prior to final acceptance, all cracks in excess of [0.02 inches](#) wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

##### 3.15.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than [1/4 inch](#) thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than [1/4 inch](#) thick must be removed and replaced or mitigated in a manner acceptable to

the Contracting Officer.

3.15.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

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## SECTION 03 30 53

## MISCELLANEOUS CAST-IN-PLACE CONCRETE

05/14

## PART 1 GENERAL

## 1.1 SUMMARY

Perform all work in accordance with ACI 318.

## 1.2 [Enter Appropriate Subpart Title Here] 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 347R	(2014; Errata 1 2017) Guide to Formwork for Concrete
ACI SP-66	(2004) ACI Detailing Manual

## ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2021a) Standard Practice for Making and

## Curing Concrete Test Specimens in the Field

ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2021) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685/C685M	(2017) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ASTM C1157/C1157M	(2020a) Standard Performance Specification for Hydraulic Cement
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E96/E96M	(2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E1155	(2020) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
ASTM E1155M	(2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers (Metric)
ASTM E1643	(2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

## U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials
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## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Installation Drawings; G

## SD-03 Product Data

Air-Entraining Admixture  
Accelerating Admixture  
Water-Reducing or Retarding Admixture  
Curing Materials  
Expansion Joint Filler Strips, Premolded  
Joint Sealants - Field Molded Sealants  
Waterstops  
Chemical Floor Hardener  
Batching and Mixing Equipment  
Conveying and Placing Concrete  
Formwork  
Mix Design Data; G  
Ready-Mix Concrete  
Curing Compound  
Mechanical Reinforcing Bar Connectors

## SD-06 Test Reports

Aggregates  
Concrete Mixture Proportions; G  
Measurement of Floor Tolerances  
Compressive Strength Testing; G  
Slump; G  
Air Content  
Water

## SD-07 Certificates

Cementitious Materials  
Pozzolan  
CPG for recycled materials or appropriate Waiver Form  
Aggregates  
Delivery Tickets

## SD-08 Manufacturer's Instructions

Chemical Floor Hardener  
Curing Compound

## 1.5 QUALITY ASSURANCE

Indicate specific locations of Concrete Placement on [installation drawings](#) and include, but not be limited to, square [feet](#) of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

## 1.5.1 Flatness and Levelness of Floor Slabs

Conduct floor flatness and levelness test, (FF and FL respectively), on floor slabs in accordance with the provisions set forth in [ASTM E1155M](#) or [ASTM E1155](#). Make floor tolerance measurements by the approved laboratory and inspection service within 24 hours after completion of final troweling



operation and before forms and shores have been removed. Provide results of floor tolerance tests, including formal notice of acceptance or rejection of the work, to the Contracting Officer within 24 hours after data collection.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with [ASTM D75/D75M](#). Sample concrete in accordance with [ASTM C172/C172M](#). Determine slump and air content in accordance with [ASTM C143/C143M](#) and [ASTM C231/C231M](#), respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with [ASTM C31/C31M](#). Test compression test specimens in accordance with [ASTM C39/C39M](#). Take samples for strength tests not less than once each shift in which concrete is produced [from each strength of concrete required]. Provide a minimum of five specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, two will be tested at 7 days for information and one held in reserve.

#### 2.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, but not more than 20 percent, and no individual acceptance test result falls below f'c by more than [500 psi](#).

#### 2.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in [ACI 117](#).

#### 2.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per [yard](#) of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f'c is [3,000 psi](#) at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is [1-1/2 inch](#), in accordance with [ACI 304R](#). The air content must be between 4.5 and 7.5 percent with a slump between [2 and 5 inches](#). The maximum water-cementitious material ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

## 2.2 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

### 2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

#### 2.2.1.1 Portland Cement

ASTM C150/C150M, Types I and II with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali content of 0.80 percent Na<sub>2</sub>O<sub>e</sub> (sodium oxide) equivalent.

#### 2.2.1.2 Blended Hydraulic Cement

Provide blended cement conforming to ASTM C595/C595M and ASTM C1157/C1157M, Type IP, IL or IS, including the optional requirement for mortar expansion [and sulfate soundness] and consist of a mixture of ASTM C150/C150M Type I, or Type II cement and a complementary cementing material. The slag added to the Type IS blend must be ASTM C989/C989M ground granulated blast-furnace slag. The pozzolan added to the Type IP blend must be ASTM C618 Class F, interground with the cement clinker. Provide the manufacturer's written statement that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. Do not change the percentage and type of mineral admixture used in the blend from that submitted for the aggregate evaluation and mixture proportioning.

#### 2.2.1.3 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F, including requirements of Tables 1A and 2A.

### 2.2.2 Aggregates

For fine and coarse aggregates meet the quality and grading requirements of ASTM C33/C33M. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

### 2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

#### 2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of

ASTM C260/C260M.

#### 2.2.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

#### 2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

#### 2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66. Provide mechanical reinforcing bar connectors in accordance with ACI 301 and provide 125 percent minimum yield strength of the reinforcement bar.

#### 2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to ASTM D1752, Type I.

#### 2.2.7 Joint Sealants - Field Molded Sealants

Conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

#### 2.2.8 Formwork

Design and engineer the formwork as well as its construction in accordance with ACI 301 Section 2 and 5 and ACI 347R. Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

#### 2.2.9 Form Coatings

Provide form coating in accordance with ACI 301.

#### 2.2.10 Vapor Retarder and VaporBarrier

Unless otherwise specified, ASTM E1745 Class C polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

### 2.2.11 Curing Materials

Provide curing materials in accordance with [ACI 301](#), Section 5.

### 2.3 READY-MIX CONCRETE

Provide ready-mix concrete with [mix design data](#) conforming to [ACI 301](#) Part 2. Submit [delivery tickets](#) in accordance with [ASTM C94/C94M](#) for each ready-mix concrete delivery, include the following additional information: .

- a. Type and brand cement
- b. Cement content in [94-pound](#) bags per cubic [yard](#) of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixture
- e. Total water content expressed by water cementitious material ratio

### 2.4 ACCESSORIES

#### 2.4.1 Waterstops

##### 2.4.1.1 PVC Waterstop

Polyvinylchloride waterstops conforming to [COE CRD-C 572](#).

##### 2.4.1.2 Rubber Waterstop

Rubber waterstops conforming to [COE CRD-C 513](#).

##### 2.4.1.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops conforming to [ASTM D471](#).

##### 2.4.1.4 Hydrophilic Waterstop

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water conforming to [ASTM D412](#) as follows: Tensile strength [420 psi](#) minimum; ultimate elongation 600 percent minimum. Minimum hardness of 50 on the type A durometer and the volumetric expansion ratio in distilled water at [70 degrees F](#); 3 to 1 minimum.

#### 2.4.2 Chemical Floor Hardener

Provide hardener which is a colorless aqueous solution containing a blend of inorganic silicate or silicate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.

#### 2.4.3 Curing Compound

Provide curing compound conforming to [ASTM C309](#). Submit manufactures instructions for placing curing compound.

### PART 3 EXECUTION

### 3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

#### 3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Provide all equipment needed to place, consolidate, protect, and cure the concrete at the placement site and in good operating condition.

#### 3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

#### 3.1.3 Vapor Retarder[ and Vapor Barrier] Installation

Install in accordance with ASTM E1643. Apply vapor retarder and barrier over gravel fill. Lap edges not less than 12 inches. Seal all joints with pressure-sensitive adhesive not less than 2 inches wide. Protect the vapor barrier at all times to prevent injury or displacement prior to and during concrete placement.

#### 3.1.4 Production of Concrete

##### 3.1.4.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

##### 3.1.4.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to ASTM C685/C685M.

##### 3.1.4.3 Batching and Mixing Equipment

The option of using an on-site batching and mixing facility is available. The facility must provide sufficient batching and mixing equipment capacity to prevent cold joints. Submit the method of measuring materials, batching operation, and mixer for review, and manufacturer's data for batching and mixing equipment demonstrating compliance with the applicable specifications.

##### 3.1.5 Waterstops

Install and splice waterstops as directed by the manufacturer.

3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with ACI 301, Section 5.

3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with ACI 306R

3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with ACI 305R

3.3 FINISHING

3.3.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.3.2 Finishing Formed Surfaces

Remove all fins and loose materials , and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Ream or chip surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete and fill with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. Use a blend of portland cement and white cement in mortar or concrete for repairs to all surfaces permanently exposed to view so that the final color when cured is the same as adjacent concrete.

3.3.3 Finishing Unformed Surfaces

Finish unformed surfaces in accordance with ACI 301, Section 5.

3.3.3.1 Flat Floor Finishes

In accordance with ACI 302.1R, construct in accordance with one of the methods recommended in Table 7.15.3, "Typical Composite FF/FL Values for Various Construction Methods." ACI 117 for tolerances tested by ASTM E1155M or ASTM E1155. These requirements are based upon the latest FF/FL method.

3.3.3.1.1 Floor Slabs

Conform floor slabs on grade to the following ACI F-number requirements unless noted otherwise:

Specified Overall Values	FF30/FL23 minimum
Minimum Local Values	FF17/FL15 minimum

3.3.3.1.2 Subject to Vehicular Traffic

Conform floor slabs on grade subject to vehicular traffic or receiving thin-set flooring to the following ACI F-number requirements:

Specified Overall Values	FF35/FL25 minimum
Minimum Local Values	FF25/FL17 minimum

### 3.3.3.2 Measurement of Floor Tolerances

Test floor slabs within 24 hours of the final troweling. Submit test results to Contracting Officer within 12 hours after collecting data. Floor flatness inspector must provide a tolerance report which includes:

- a. Name of Project
- b. Name of Contractor
- c. Date of Data Collection
- d. Date of Tolerance Report
- e. A Key Plan Showing Location of Data Collected
- f. Results Required by [ASTM E1155M](#) [ASTM E1155](#)

### [3.3.3.3 Expansion and Contraction Joints

Make expansion and contraction joints in accordance with the details shown or as otherwise specified. Provide [1/2 inch](#) thick transverse expansion joints where new work abuts an existing concrete. Provide expansion joints at a maximum spacing of [30 feet](#) on center in sidewalks , unless otherwise indicated. Provide contraction joints at a maximum spacing of [6 linear feet](#) in sidewalks , unless otherwise indicated. Cut contraction joints at a minimum of [1 inch](#) deep with a jointing tool after the surface has been finished.

### ]3.4 CURING AND PROTECTION

Cure and protect in accordance with [ACI 301](#), Section 5.

### 3.5 FORM WORK

Provide form work in accordance with [ACI 301](#), Section 2 and Section 5.

#### 3.5.1 Removal of Forms

Remove forms in accordance with [ACI 301](#), Section 2.

### 3.6 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

#### 3.6.1 Fabrication

Shop fabricate steel reinforcement in accordance with [ACI 318](#) and [ACI SP-66](#). Provide shop details and bending in accordance with [ACI 318](#) and [ACI SP-66](#).

#### 3.6.2 Splicing

Perform splices in accordance with [ACI 318](#) and [ACI SP-66](#).

### 3.6.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

### 3.7 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

### 3.8 CHEMICAL FLOOR HARDENER

Apply Chemical Floor Hardener where indicated, after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat is one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow it to dry 24 hours before applying next coat. Apply proprietary chemical hardeners in accordance with manufacturer's printed directions.

### 3.9 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period. See Section [01 45 00.00 10](#) QUALITY CONTROL.

#### 3.9.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

#### 3.9.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

#### 3.9.3 Sampling and Testing

- a. Obtain samples and test concrete for quality control during placement. Sample fresh concrete for testing in accordance with [ASTM C172/C172M](#). Make six test cylinders.
- b. Test concrete for compressive strength at 7 and 28 days for each design mix and for every [100 cubic yards](#) of concrete. Test two cylinders at 7 days; two cylinders at 28 days; and hold two cylinders in reserve. Conform test specimens to [ASTM C31/C31M](#). Perform [compressive strength testing](#) conforming to [ASTM C39/C39M](#).
- c. Test [slump](#) at the [plant] [site of discharge] for each design mix in accordance with [ASTM C143/C143M](#). Check slump once during each shift that concrete is produced for each strength of concrete required.



- d. Test **air content** for air-entrained concrete in accordance with **ASTM C231/C231M**. Test concrete using lightweight or extremely porous aggregates in accordance with **ASTM C173/C173M**. Check air content at least once during each shift that concrete is placed for each strength of concrete required.
- e. Determine temperature of concrete at time of placement in accordance with **ASTM C1064/C1064M**. Check concrete temperature at least once during each shift that concrete is placed for each strength of concrete required.

#### 3.9.4 Action Required

##### 3.9.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

##### 3.9.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

##### 3.9.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

-- End of Section --

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## SECTION 03 33 00

## CAST-IN-PLACE ARCHITECTURAL CONCRETE

11/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

- ACI 211.1** (1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
- ACI 211.2** (1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
- ACI 301** (2016) Specifications for Structural Concrete
- ACI 318** (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
- ACI 347R** (2014; Errata 1 2017) Guide to Formwork for Concrete
- ACI SP-66** (2004) ACI Detailing Manual

## ASTM INTERNATIONAL (ASTM)

- ASTM A36/A36M** (2019) Standard Specification for Carbon Structural Steel

## 1.2 SYSTEM DESCRIPTION

All materials, procedures, and requirements specified in Section 03 30 00 CAST-IN-PLACE CONCRETE fully apply to cast-in-place architectural concrete, except as otherwise specified.

## 1.2.1 Concrete Mix Design

Design the concrete mix in accordance with **ACI 211.1** and **ACI 211.2** including consideration of the finishes required.

## 1.2.2 Formwork Design

Design formwork conforming to **ACI 301** and **ACI 347R**.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings.

SD-04 Samples

Materials

Panels

1.4 QUALITY ASSURANCE

1.4.1 Detail Drawings

Submit detail drawings conforming to ACI SP-66 and ACI 318. Show location of cast-in-place elements in the work, building elevations, formwork fabrication details, reinforcements, embedments, dimensions, concrete strength, interface with adjacent materials, and special placing instructions, in sufficient detail to cover fabrication, placement, stripping, and finishing.

1.4.2 Panels

Provide sample panels 6 feet long and 4 feet high with the thickness to match building conditions for each type of architectural concrete and finish, located where directed. Panel forms include a typical joint between form panels, form tie conditions and finishes. Protect panels from weather, and other damage until acceptance of work. Use sample panels as job standards throughout construction. Submit a sample panel for approval.

PART 2 PRODUCTS

2.1 MATERIALS

Submit samples of materials listed below, indicating sizes, shapes, finishes, color, and pertinent accessories.

2.1.1 Aggregates

Provide aggregates conforming to ASTM C33.

2.1.2 Reinforcing Steel

Provide galvanized reinforcing steel if clearance to an exterior face is 1 inch or less.

2.1.3 Tie Wire

Provide soft monel or 18-8 stainless steel tie wire.

2.1.4 Plates, Angles, Anchors, and Embedments

Provide plates, angles, anchors, and embedments conforming to ASTM A36/A36M, and prime paint with inorganic zinc primer.

### 2.1.5 Formwork

Use approved formwork for special effects.

### 2.1.6 Form Release Agents

Provide manufacturer's standard form release agents that are nonstaining, nonpetroleum based, and compatible with surface sealer finish coating.

### 2.1.7 Surface Sealer

Provide surface sealer consisting of methyl methacrylate polymer acrylic emulsion, clear color.

## PART 3 EXECUTION

### 3.1 FORMWORK ERECTION

Erect formwork in accordance with the detail drawings to ensure that the finished concrete members conform accurately to the indicated dimensions, lines, elevations, and finishes. Deflection exceeding 1/360th of each component span or distance between adjacent supports is not acceptable. Cumulative deflections and tolerance is not acceptable. Install form lines as necessary to provide the required finish. Coat forms with form release agents before reinforcement is placed. Provide formwork conforming to [ACI 301](#) and [ACI 347R](#).

### 3.2 CONCRETE FINISHES

Concrete finishes must conform to the approved finishes. Accomplish finishing at the time of concrete placement or immediately after formwork removal, as follows:

- a. Smooth finish: (1) As cast using flat smooth nonporous forms. (2) As cast using fluted, sculptured, board finish or textured form liners.
- b. Textured finish: (1) Textured form liners applied to inside of forms. (2) Distress finish by breaking off portion of face of raised portion of unit.
- c. Exposed aggregate finish: (1) Finish obtained by applying even coat of retardant to face of form, removing forms after concrete hardens, and exposing coarse aggregate to a depth by washing and brushing or lightly sandblasting away surface mortar. [Depth of exposure to be determined by project requirements](#). (2) Finish obtained by treating surface of unit with brushes which have been immersed in acid solution.

### 3.3 JOINT SEALING

Perform joint sealing as specified in Section [07 92 00 JOINT SEALANTS](#).

### 3.4 CLEANING

No sooner than 72 hours after joints are sealed, wash down, clean with soap and apply water with a soft bristle brush to faces and other exposed surfaces of cast-in-place concrete, then wash down again with clean water, or clean by other approved procedures. Consider discolorations which cannot be removed by these procedures defective work. Perform cleaning work

when temperature and humidity conditions are such that surfaces dry rapidly. Take care during cleaning operations to protect adjacent surfaces from damage.

### 3.5 SURFACE SEALING

After cleaning, give indicated exterior exposed architectural concrete surfaces one coat of surface sealer, spray apply unless otherwise approved. Protect adjacent surfaces to prevent damage from the surface sealer.

### 3.6 PROTECTION OF WORK

Protect work against damage from subsequent operations.

### 3.7 DEFECTIVE WORK

Repair or replace defective work, as directed, using approved procedures.

-- End of Section --

## SECTION 03 42 13.00 10

PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION  
05/16

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

- ACI 211.1 (1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
- ACI 211.2 (1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
- ACI 305R (2020) Guide to Hot Weather Concreting
- ACI 306.1 (1990; R 2002) Standard Specification for Cold Weather Concreting
- ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

## AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

- ACPA 01-102 (2000) Concrete Pipe Handbook
- ACPA 01-110 (1984) Design Manual for Sulfide and Corrosion Prediction and Control
- ACPA QPC (202016) QCast Plant Certification Manual

## AMERICAN WELDING SOCIETY (AWS)

- AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel
- AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

## ASTM INTERNATIONAL (ASTM)

- ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel
- ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2016) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2017) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884/A884M	(2019) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2021a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39/C39M	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C138/C138M	(2017a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C171	(2020) Standard Specification for Sheet Materials for Curing Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C192/C192M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C443	(2021) Standard Specification for Joints



for Concrete Pipe and Manholes, Using  
Rubber Gaskets

- ASTM C857 (2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
- ASTM C858 (2010; E 2012) Standard Specification for Underground Precast Concrete Utility Structures
- ASTM C877 (2021) Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
- ASTM C891 (2020) Standard Practice for Installation of Underground Precast Concrete Utility Structures
- ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants
- ASTM C923 (2008; R 2013; E 2016) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
- ASTM C990 (2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- ASTM C1064/C1064M (2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- ASTM C1107/C1107M (2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonsrink)
- ASTM C1116/C1116M (2010a; R 2015) Standard Specification for Fiber-Reinforced Concrete
- ASTM C1244 (2020) Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
- ASTM C1478 (2019) Standard Specification for Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes and Laterals
- CSA GROUP (CSA)
- CSA A23.4 (2016; R 2021) Precast Concrete - Materials and Construction
- NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)
- NPCA QC Manual (2017) Quality Control Manual for Precast

## and Prestressed Concrete Plants

## 1.2 SUBMITTALS

All submittals are the responsibility of the precast concrete producer. Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Quality Control Procedures

## SD-02 Shop Drawings

Standard Precast Units; G  
Custom-Made Precast Units; G  
Special Finishes

## SD-03 Product Data

Standard Precast Units  
Proprietary Precast Units  
Embedded Items  
Accessories

## SD-05 Design Data

Design Calculations  
Concrete Mix Proportions

## SD-06 Test Reports

Test Reports

## SD-07 Certificates

Quality Control Procedures

## SD-11 Closeout Submittals

Recycled content for fly ash and pozzolan; S  
Recycled content for Ground Iron Blast-Furnace Slag; S  
Recycled content for Silica Fume; S  
Recycled content for Synthetic Fiber Reinforcement; S  
Recycled content for steel; S

## 1.3 QUALITY ASSURANCE

Demonstrate adherence to the standards set forth in [NPCA QC Manual](#) or [ACPA QPC](#). Meet requirements written in the subparagraphs below.

## 1.3.1 NPCA and ACPA Plant Certification

The precast concrete producer must be certified by the National Precast Concrete Association's or the American Concrete Pipe Association's Plant Certification Program prior to and during production of the products for this project.

### 1.3.2 Qualifications, Quality Control and Inspection

#### 1.3.2.1 Qualifications

Select a precast concrete producer that has been in the business of producing precast concrete units similar to those specified for a minimum of 3 years. The precast concrete producer must maintain a permanent quality control department or retain an independent testing agency on a continuing basis.

#### 1.3.2.2 Quality Control Procedures

Submit quality control procedures established by the precast manufacturer in accordance with [NPCA QC Manual](#) and [ACPA QPC](#). Show that the following QC tests are performed as required and in accordance with the ASTM standards indicated.

##### 1.3.2.2.1 Slump

Perform a slump test for each 150 cu yd of concrete produced, or once a day, whichever comes first. Perform slump tests in accordance with [ASTM C143/C143M](#).

##### 1.3.2.2.2 Temperature

Measure the temperature of fresh concrete when slump or air content tests are made and when compressive test specimens are made in accordance with [ASTM C1064/C1064M](#).

##### 1.3.2.2.3 Compressive Strength

Make at least four compressive strength specimens for each 150 cubic yards of concrete of each mix in accordance with the following Standards: [ASTM C31/C31M](#), [ASTM C192/C192M](#), [ASTM C39/C39M](#).

##### 1.3.2.2.4 Air Content

Perform tests for air content on air-entrained, wet-cast concrete for each 150 cu yd of concrete, but not less often than once each day when air-entrained concrete is used. Determine the air content in accordance with either [ASTM C231/C231M](#) or [ASTM C173/C173M](#) for normal weight aggregates and [ASTM C173/C173M](#) for lightweight aggregates.

##### 1.3.2.2.5 Unit Weight

Perform tests for unit weight a minimum of once per week to verify the yield of batch mixes. Perform unit weight tests for each 100 cu yd of lightweight concrete in accordance with [ASTM C138/C138M](#).

#### 1.3.2.3 Inspection

The Contracting Officer may place an inspector in the plant when the units covered by this specification are being manufactured. The burden of payment for plant inspection will be clearly detailed in the specification. The precast concrete producer must give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are

transported or erected.

#### 1.3.2.4 Test Reports

Submit the following:

##### 1.3.2.4.1 Material Certifications or Laboratory Test Reports

Include mill tests and all other test data, for portland cement, blended cement, pozzolans, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

##### 1.3.2.4.2 Mix Test

Submit reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze thaw durability, abrasion and absorption. Clearly detail in the specifications special tests for precast concrete or cast-in items.

##### 1.3.2.4.3 Self-Consolidating Concrete

Submit sufficient documentation, when the use of self-consolidating concrete (SCC) is proposed, showing a minimum of 30-days production track records demonstrating that SCC is appropriate for casting of the product.

##### 1.3.2.4.4 In-Plant QA/QC Inspection Reports

Submit inspection reports upon the request of the Contracting Officer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

##### 1.4.1 Delivery

Deliver precast units to the site in accordance with the delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite, all precast concrete units will be inspected by the Contracting Officer for quality and final acceptance.

##### 1.4.2 Storage

Store units off the ground or in a manner that minimizes potential damage.

##### 1.4.3 Handling

Handle, transport, and store products in a manner to minimize damage. Lifting devices or holes must be consistent with industry standards. Perform lifting with methods or devices intended for this purpose as indicated on shop drawings.

#### PART 2 PRODUCTS

##### 2.1 SYSTEM DESCRIPTION

Furnish precast concrete units designed and fabricated by an experienced and acceptable precast concrete manufacturer who has been, for at least three years, regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings.

Coordinate precast work with the work of other trades. Below grade structures must comply with [ASTM C858](#).

#### 2.1.1 Standard Precast Units

Design standard precast concrete units to withstand indicated design load conditions in accordance with applicable industry design standards [ACI 318](#), [ASTM C857](#). Design must also consider stresses induced during handling, shipping and installation as to avoid product cracking or other handling damage. Indicate design loads for precast concrete units on the shop drawings. Submit drawings for standard precast concrete units furnished by the precast concrete producer for approval by the Contracting Officer. These drawings must demonstrate that the applicable industry design standards have been met. Include installation and construction information on shop drawings. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings. Submit cut sheets, for standard precast concrete units, showing conformance to project drawings and requirements, and to applicable industry design standards listed in this specification.

#### 2.1.2 Custom-Made Precast Units

Submit [design calculations](#) for custom-made precast units, prepared and sealed by a registered professional engineer, for approval prior to fabrication. Include in the calculations the analysis of units for lifting stresses and the sizing of lifting devices. Submit drawings furnished by the precast concrete producer for approval by the Contracting Officer. Show on these drawings complete design, installation, and construction information in such detail as to enable the Contracting Officer to determine the adequacy of the proposed units for the intended purpose. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings.

#### 2.1.3 Proprietary Precast Units

Products manufactured under franchise arrangements must conform to all the requirements specified by the franchiser. Items not included in the franchise specification, but included in this specification, must conform to the requirements in this specification. Submit standard plans or informative literature, for proprietary precast concrete units. Make available supporting calculations and design details upon request. Provide sufficient information as to demonstrate that such products will perform the intended task.

#### 2.1.4 Joints and Sealants

Provide joints and sealants between adjacent units of the type and configuration indicated on shop drawings meeting specified design and performance requirements.

#### 2.1.5 Concrete Mix Design

##### 2.1.5.1 Concrete Mix Proportions

Base selection of proportions for concrete on the methodology presented in [ACI 211.1](#) for normal weight concrete and [ACI 211.2](#) for lightweight concrete. Develop the concrete proportions using the same type and brand

of cement, the same type and brand of pozzolan, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Do not use calcium chloride in precast concrete containing reinforcing steel or other embedded metal items. At a minimum of thirty days prior to precast concrete unit manufacturing, the precast concrete producer will submit a mix design and proportions for each strength and type of concrete that will be used. Furnish a complete list of materials, including quantity, type, brand and applicable data sheets for all mix design constituents as well as applicable reference specifications. The use of self-consolidating concrete is permitted, provided that mix design proportions and constituents meet the requirements of this specification.

2.1.5.2 Concrete Strength

Provide precast concrete units with a 28-day compressive strength (f'c) of 5,000 psi.

2.1.5.3 Water-to-Cement Ratio

Where exposed to freezing and thawing, furnish concrete containing entrained air and with a water-cementitious ratio of 0.45 or less. Where not exposed to freezing, but required to have a low permeability, furnish concrete with a water-cementitious ratio of 0.48 or less. Where exposed to deicer salts, brackish water, or seawater, furnish concrete with a water-cementitious ratio of 0.40 or less, for corrosion protection.

2.1.5.4 Air Content

The air content of concrete that will be exposed to freezing conditions must be within the limits given below.

NOMINAL MAXIMUM AGGREGATE SIZE	AIR CONTENT PERCENT	
	EXPOSURE CLASS F1	EXPOSURE CLASSES F2 and F3
3/8 inch	6.0	7.5
1/2 inch	5.5	7.0
3/4 inch	5.0	6.0
1.0 inch	4.5	6.0
1.5 inch	4.5	5.5

Note: For specified compressive strengths greater than 5000 psi, air content may be reduced 1 percent

2.1.5.5 Corrosion Control for Sanitary Sewer Systems

Follow design recommendations outlined in Chapter 7 of ACPA 01-102 or the ACPA 01-110 when hydrogen sulfide is indicated as a potential problem.

2.2 MATERIALS

Except as otherwise specified in the following paragraphs, conform material to Section 03 30 00 CAST-IN-PLACE CONCRETE.

#### 2.2.1 Material Sustainability Criteria

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING:

- a. Recycled content for fly ash and pozzolan
- b. Recycled content for Ground Iron Blast-Furnace Slag
- c. Recycled content for Silica Fume
- d. Recycled content for Synthetic Fiber Reinforcement
- e. Recycled content for steel, 75 percent minimum

#### 2.2.2 Pigments

Non-fading and lime-resistant

#### 2.2.3 Reinforcement

##### 2.2.3.1 Reinforcing Bars

- a. Deformed Billet-steel: ASTM A615/A615M
- b. Deformed Low-alloy steel: ASTM A706/A706M

##### 2.2.3.2 Reinforcing Wire

- a. Plain Wire: ASTM A1064/A1064M
- b. Deformed Wire: ASTM A1064/A1064M

##### 2.2.3.3 Welded Wire Reinforcement

- a. Plain Wire: ASTM A1064/A1064M
- b. Deformed Wire: ASTM A1064/A1064M

##### 2.2.3.4 Epoxy Coated Reinforcement

- a. Reinforcing Bars: ASTM A775/A775M
- b. Wires and Welded Wire: ASTM A884/A884M

##### 2.2.3.5 Galvanized Reinforcement

Provide galvanized reinforcement conforming to ASTM A767/A767M.

#### 2.2.4 Synthetic Fiber Reinforcement

Provide fiber reinforced concrete in accordance with ASTM C1116/C1116M Type III, synthetic fiber reinforced concrete, and as follows. Synthetic reinforcing fibers must be monofilament polypropylene fibers. Provide fibers that have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement.

### 2.2.5 Inserts and Embedded Metal

All items embedded in concrete must be of the type required for the intended task, and meet the following standards.

- a. Structural Steel Plates, Angles, etc.: [ASTM A36/A36M](#)
- b. Hot-dipped Galvanized: [ASTM A153/A153M](#)
- c. Proprietary Items: In accordance with manufacturers published literature

### 2.2.6 Accessories

Submit proper installation instructions and relevant product data for items including, but not limited to, sealants, gaskets, connectors, steps, cable racks and other items installed before or after delivery.

- a. Rubber Gaskets for Circular Concrete Sewer Pipe and Culvert Pipe: [ASTM C443](#).
- b. External Sealing Bands for Noncircular Sewer, Storm Drain and Culvert Pipe: [ASTM C877](#).
- c. Preformed Flexible Joint Sealants for Concrete Pipe, Manholes, and Manufactured Box Sections: [ASTM C990](#).
- d. Elastomeric Joint Sealants: [ASTM C920](#)

### 2.2.7 Pipe Entry Connectors

Pipe entry connectors must conform to [ASTM C923](#) or [ASTM C1478](#).

### 2.2.8 Grout

Nonshrink Grout must conform to [ASTM C1107/C1107M](#). Cementitious grout must be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method.

## PART 3 EXECUTION

### 3.1 FABRICATION AND PLACEMENT

Perform fabrication in accordance with [NPCA QC Manual](#) or [ACPA QPC](#) unless specified otherwise.

#### 3.1.1 Forms

Use forms, for manufacturing precast concrete products, of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Construct forms so that the forces and vibrations to which the forms will be subjected can cause no product damage. Clean forms of concrete build-up after each use. Apply form release agents according to the manufacturers recommendations and do not allow to build up on the form casting surfaces.

#### 3.1.2 Reinforcement

Follow applicable ASTM Standard or [ACI 318](#) for placement and splicing.



Fabricate cages of reinforcement either by tying the bars, wires or welded wire reinforcement into rigid assemblies or by welding, where permissible, in accordance with AWS D1.4/D1.4M. Position reinforcing as specified by the design and so that the concrete cover conforms to requirements. The tolerance on concrete cover must be one-third of that specified but not more than 1/2 inch. Provide concrete cover not less than 1/2 inch. Take positive means to assure that the reinforcement does not move significantly during the casting operations.

### 3.1.1.3 Embedded Items

Position embedded items at locations specified in the design documents. Perform welding in accordance with AWS D1.1/D1.1M when necessary. Hold rigidly in place inserts, plates, weldments, lifting devices and other items to be imbedded in precast concrete products so that they do not move significantly during casting operations. Submit product data sheets and proper installation instruction for anchors, lifting inserts and other devices. Clearly indicate the products dimensions and safe working load.

### 3.1.1.4 Synthetic Fiber Reinforced Concrete

Add fiber reinforcement to the concrete mix at the batch plant in accordance with the applicable sections of ASTM C1116/C1116M and the recommendations of the manufacturer. Use a minimum of 1.5 pounds of fibers per cubic yard of concrete.

## 3.2 CONCRETE

### 3.2.1 Concrete Mixing

Mixing operations must produce batch-to-batch uniformity of strength, consistency, and appearance.

### 3.2.2 Concrete Placing

Deposit concrete into forms as near to its final location as practical. Keep the free fall of the concrete to a minimum. Consolidate concrete in such a manner that segregation of the concrete is minimized and honeycombed areas are kept to a minimum. Use vibrators to consolidate concrete with frequencies and amplitudes sufficient to produce well consolidated concrete.

#### 3.2.2.1 Cold Weather Concreting

Perform cold weather concreting in accordance with ACI 306.1.

- a. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather.
- b. All concrete materials, reinforcement, forms, fillers, and ground with which concrete is to come in contact must be free from frost.
- c. Do not use frozen materials or materials containing ice.
- d. In cold weather the temperature of concrete at the time of placing must not be below 45 degrees F. Discard concrete that freezes before its compressive strength reaches 500 psi.

#### 3.2.2.2 Hot Weather Concreting

Follow recommendations for hot weather concreting in [ACI 305R](#). During hot weather, give proper attention to constituents, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that could impair required strength or serviceability of the member or structure. The temperature of concrete at the time of placing must not exceed [90 degrees F](#).

### 3.2.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing.

#### 3.2.3.1 Curing by Moisture Retention

Prevent moisture evaporation from exposed surfaces until adequate strength for stripping is reached by one of the following methods:

- a. Cover with polyethylene sheets a minimum of [6 mils](#) thick in accordance with [ASTM C171](#).
- b. Cover with burlap or other absorptive material and keep continually moist.
- c. Use a membrane-curing compound, conforming to [ASTM C309](#) and applied at a rate not less than [200 square ft/gallon](#), or in accordance with manufacturers' recommendations.

#### 3.2.3.2 Curing with Heat and Moisture

Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Apply steam, if used, within a suitable enclosure, which permits free circulation of the steam in accordance with [CSA A23.4](#). If hot air is used for curing, take precautions to prevent moisture loss from the concrete. The temperature of the concrete must not be permitted to exceed [150 degrees F](#). These requirements do not apply to products cured with steam under pressure in an autoclave.

### 3.2.4 Surface Finish

Finish unformed surfaces of wet-cast precast concrete products as specified. If no finishing procedure is specified, finish such surfaces using a strike-off to level the concrete with the top of the form.

#### 3.2.4.1 Formed Non-Architectural Surfaces

Cast surfaces against approved forms following industry practices in cleaning forms, designing concrete mixes, placing and curing concrete. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be accepted but no major imperfections, honeycombs or other major defects will be permitted.

#### 3.2.4.2 Unformed Surfaces

Finish unformed surfaces with a vibrating screed, or by hand with a float. Normal color variations, minor indentations, minor chips and spalls will be accepted. Major imperfections, honeycombs, or other major defects are not permitted.

#### 3.2.4.3 Special Finishes

Troweled, broom or other finishes must be according to the requirements of project documents and performed in accordance with industry standards or supplier specifications. Submit finishes for approval when required by the project documents. The sample finishes must be approved prior to the start of production.

### 3.2.5 Stripping Products from Forms

Do not remove products from the forms until the concrete reaches the compressive strength for stripping required by the design. If no such requirement exists, products may be removed from the forms after the final set of concrete provided that stripping damage is minimal.

### 3.2.6 Patching and Repair

No repair is required to formed surfaces that are relatively free of air voids and honeycombed areas, unless the surfaces are required by the design to be finished.

#### 3.2.6.1 Repairing Minor Defects

Defects that will not impair the functional use or expected life of a precast concrete product may be repaired by any method that does not impair the product.

#### 3.2.6.2 Repairing Honeycombed Areas

When honeycombed areas are to be repaired, remove all loose material and cut back the areas into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Use proprietary repair materials in accordance with the manufacturer's instructions. If a proprietary repair material is not used, saturate the area with water. Immediately prior to repair, the area should be damp, but free of excess water. Apply a cement-sand grout or an approved bonding agent to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

#### 3.2.6.3 Repairing Major Defects

Evaluate, by qualified personnel, defects in precast concrete products which impair the functional use or the expected life of products to determine if repairs are feasible and, if so, to establish the repair procedure.

### 3.2.7 Shipping Products

Do not ship products until they are at least five days old, unless it can be shown that the concrete strength has reached at least 75 percent of the specified 28-day strength, or that damage will not result, impairing the performance of the product.

## 3.3 INSTALLATION

### 3.3.1 Site Access

It is the Contractor's responsibility to provide adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete products.

### 3.3.2 General Requirements

- a. Install precast concrete products to the lines and grades shown in the contract documents or otherwise specified.
- b. Lift products by suitable lifting devices at points provided by the precast concrete producer.
- c. Install products in accordance with the precast concrete producer's instructions. In the absence of such instructions, install underground utility structures in accordance with [ASTM C891](#). Install pipe and manhole sections in accordance with the procedures outlined by the American Concrete Pipe Association.
- d. Field modifications to the product will relieve the precast producer of liability even if such modifications result in the failure of the product.

### 3.3.3 Water Tightness

Where water tightness is a necessary performance characteristic of the precast concrete product's end use, watertight joints, connectors and inserts should be used to ensure the integrity of the entire system.

## 3.4 FIELD QUALITY CONTROL

### 3.4.1 Site Tests

When water tightness testing is required for an underground product, use one of the following methods:

### 3.4.2 Vacuum Testing

Prior to backfill vacuum test system according to [ASTM C1244](#).

### 3.4.3 Water Testing

Perform water testing according to the contract documents and precast concrete producer's recommendations.

-- End of Section --

## SECTION 04 20 00

## UNIT MASONRY

11/15, CHG 2: 05/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

- ACI 216.1 (2014) Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
- ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
- ACI SP-66 (2004) ACI Detailing Manual

## ASTM INTERNATIONAL (ASTM)

- ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- ASTM A185/A185M (2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
- ASTM A615/A615M (2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- ASTM A641/A641M (2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
- ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM A951/A951M (2011) Standard Specification for Steel Wire for Masonry Joint Reinforcement
- ASTM A996/A996M (2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars

	for Concrete Reinforcement
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM B370	(2022) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C27	(1998; R 2008) Fireclay and High-Alumina Refractory Brick
ASTM C55	(2017) Standard Specification for Concrete Building Brick
ASTM C67/C67M	(2021) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C73	(2017) Standard Specification for Calcium Silicate Brick (Sand-Lime Brick)
ASTM C90	(2021) Standard Specification for Loadbearing Concrete Masonry Units
ASTM C129	(2017) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C216	(2021) Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C270	(2019a; E 2019) Standard Specification for Mortar for Unit Masonry
ASTM C315	(2007; R 2021) Standard Specification for Clay Flue Linings and Chimney Pots
ASTM C476	(2020) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C586	(2011) Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks as Concrete Aggregates (Rock-Cylinder Method)
ASTM C616/C615M	(2011) Standard Specification for Granite Dimension Stone

ASTM C616/C616M	(2010) Standard Specification for Quartz-Based Dimension Stone
ASTM C641	(2017) Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2021) Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C744	(2021) Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C780	(2020) Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C979/C979M	(2016) Standard Specification for Pigments for Integrally Colored Concrete
ASTM C1019	(2019) Standard Test Method for Sampling and Testing Grout
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars
ASTM C1405	(2015) Standard Specification for Glazed Brick (Single Fired, Brick Units)
ASTM C1611/C1611M	(2021) Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM C1634	(2011) Standard Specification for Concrete Facing Brick
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2287	(2019) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E514/E514M	(2020) Standard Test Method for Water Penetration and Leakage Through Masonry

## THE MASONRY SOCIETY (TMS)

TMS MSJC	(2016) Masonry Standard Joint Committee's (MSJC) Book - Building Code Requirements and Specification for Masonry Structures, Containing TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6, and Companion Commentaries
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Cut CMU Drawings; G

Reinforcement Detail Drawings; G

SD-03 Product Data

Hot Weather Procedures; G

Cold Weather Procedures; G

Clay or Shale Brick; G

Glazed Structural Clay Facing Tile; G

Glazed Brick; G

Salvaged Brick; G

Cement; G

Cementitious Materials; G

Insulation; G

SD-04 Samples

Mock-Up Panel; G

Clay or Shale Brick; G

Glazed Structural Clay Facing Tile; G

Glazed Brick; G

Concrete Masonry Units (CMU); G

Concrete Brick; G

Dimension Stone Units; G

Admixtures for Masonry Mortar; G

Anchors, Ties, and Bar Positioners; G

Joint Reinforcement; G

Clay Masonry Expansion-Joint Materials; G

Insulation; G

SD-05 Design Data

Masonry Compressive Strength; G



Fire-Rated Concrete Masonry Units

Bracing Calculations

SD-06 Test Reports

Efflorescence Test

Fire-Rated Concrete Masonry Units

Field Testing of Mortar

Field Testing of Grout

Prism Tests

Single-Wythe Masonry Wall Water Penetration Test

SD-07 Certificates

Special Masonry Inspector Qualifications

Clay or Shale Brick

Glazed Structural Clay Facing Tile

Glazed Brick

Concrete Masonry Units (CMU)

Concrete Brick

Precast Concrete Units

Cementitious Materials

Admixtures for Masonry Mortar

Admixtures for Grout

Anchors, Ties, and Bar Positioners

Joint Reinforcement

Insulation

Insulation

SD-08 Manufacturer's Instructions

Admixtures for Masonry Mortar

Admixtures for Grout

SD-10 Operation and Maintenance Data

Take-Back Program

## SD-11 Closeout Submittals

Recycled Content of [Clay Units](#)

[Recycled Content](#) of Cement

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Masonry Mock-Up Panels

##### 1.3.1.1 Mock-Up Panel Location

After material samples are approved and prior to starting masonry work, construct a [mock-up panel](#) for each type and color of masonry required. At least 48 hours prior to constructing the panel or panels, submit written notification to the Contracting Officer. Do not build-in mock-up panels as part of the structure; locate mock-up panels where directed. Construct portable mock-up panels or locate in an area where they will not be disrupted during construction.

##### 1.3.1.2 Mock-Up Panel Configuration

If [project specifies](#), construct mock-up panels L-shaped or otherwise configured to represent all of the wall elements. Construct panels of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. Provide a straight panel or a leg of an L-shaped panel of minimum size [8 feet](#) long by [4 feet](#) high.

##### 1.3.1.3 Mock-Up Panel Composition

Show full color range, texture, and bond pattern of the masonry work. Demonstrate mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work during the construction of the panels. Also include installation or application procedures for anchors, wall ties, [CMU control joints](#), [brick expansion joints](#), [insulation](#), flashing, [brick soldier](#), [row lock courses](#) and [weepers](#). When the panel represents reinforced masonry, include a [2 by 2 foot](#) opening placed at least [2 feet](#) above the panel base and [2 feet](#) away from all free edges, corners, and control joints. Provide required reinforcing around this opening as well as at wall corners and control joints.

##### 1.3.1.4 Mock-Up Panel Construction Method

Where anchored veneer walls or cavity walls are required, demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Demonstrate provisions to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. When water-repellent is specified to be applied to the masonry, apply the approved product to the mock-up panel. Construct panels on a properly designed concrete foundation.

##### 1.3.1.5 Mock-Up Panel Purpose

The completed panels is used as the standard of workmanship for the type of masonry represented. Do not commence masonry work until the mock-up panel for that type of masonry construction has been completed and approved. Protect panels from the weather and construction operations until the masonry work has been completed and approved. Perform cleaning procedures on the mockup and obtain approval of the Contracting Officer prior to cleaning the building. After completion of the work, completely remove the mock-up panels, including all foundation concrete, from the construction site.

#### 1.3.2 Special Masonry Inspector Qualifications

Refer to Section 01 45 35 SPECIAL INSPECTIONS for qualifications and responsibilities of the masonry special inspector.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

##### 1.4.1 Masonry Units

Cover and protect masonry units from precipitation. Conform to handling and storage requirements of TMS MSJC.

- a. Pack glazed brick, glazed structural clay tile, and prefaced concrete masonry units in the manufacturer's standard paper cartons, trays, or shrink wrapped pallets with a divider between each unit. Do not stack pallets. Do not remove units from cartons until cartons are placed on scaffolds or in the location where units are to be laid.
- b. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

##### 1.4.2 Reinforcement, Anchors, and Ties

Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.

##### 1.4.3 Cementitious Materials, Sand and Aggregates

Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination and segregation.

#### 1.5 PROJECT/SITE CONDITIONS

Conform to TMS MSJC for hot and cold weather masonry erection.

##### 1.5.1 Hot Weather Procedures

When ambient air temperature exceeds 100 degrees F, or exceeds 90 degrees F

and the wind velocity is greater than 8 mph, comply with TMS MSJC Article 1.8 D for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

#### 1.5.2 Cold Weather Procedures

When ambient temperature is below 40 degrees F, comply with TMS MSJC Article 1.8 C for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Design - Specified Compressive Strength of Masonry

The specified compressive strength of masonry,  $f'm$ , is as indicated for each type of masonry.

#### 2.1.2 Performance - Verify Masonry Compressive Strength

Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS MSJC. Submit calculations and certifications of unit and mortar strength.

Verify specified compressive strength of masonry using the "Prism Test Method" of TMS MSJC when the "Unit Strength Method" cannot be used. Submit test results.

### 2.2 MANUFACTURED UNITS

#### 2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

#### 2.2.2 Clay or Shale Brick

##### 2.2.2.1 General

###### 2.2.2.1.1 Sample Submittal

Submit brick samples as specified, showing the color range and texture of clay or shale brick. Limit units used on the project to those that conform to the approved sample. Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape.

###### 2.2.2.1.2 Uniformity

Manufacture bricks at one time and from the same run. Deliver clay or shale brick units factory-blended to provide a uniform appearance and color range

in the completed wall.

#### 2.2.2.1.3 Efflorescence Test

Test clay brick that will be exposed to weathering for efflorescence in accordance with **ASTM C67/C67M**. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Units meeting the definition of "effloresced" are subject to rejection.

#### 2.2.2.2 Solid Clay or Shale Brick

Provide solid clay or shale brick that conforms to **ASTM C216**, Type FBS or FBX as indicated. Where brick cores, recesses, or deformation would be exposed to view, provide 100 percent solid units. Provide brick with texture and color tange to match the brick indicated.

Provide brick with specified sizes.

- a. Modular size, 3-5/8 inches thick, 2-1/4 inches high, and 7-5/8 inches long.
- b. Closure size, 3-5/8 inches thick, 3-5/8 inches high, and 7-5/8 inches long.

#### 2.2.2.3 Hollow Clay or Shale Brick

Provide hollow clay or shale brick that conforms to **ASTM C652**, Type HBS or HBX.

- a. Provide brick size of 2-1/4 inches thick, 2-1/4 inches high, and 7-5/8 inches long.
- b. Where vertical reinforcement is shown in hollow brick, provide hollow brick designed to provide precise vertical alignment of the cells, with minimum cell dimension of 2-1/2 inches.

#### 2.2.2.4 Refractory Brick

Provide brick units that comply with **ASTM C27**, low-duty type.

#### 2.2.2.5 Glazed Brick and Glazed Structural Clay Facing Tile

Provide ceramic glazed brick and glazed facing tile conforming to **ASTM C1405**, Type I, Grade SS, glaze as indicated. In two-faced walls, Type II units may be used for the base course. Provide all shapes and sizes for a complete installation. Use bullnose units along sills and caps and at vertical external corners including door jambs, window jambs, and other such openings. Provide coved base units to meet finished floor surfaces where ceramic tile floor occurs.

- a. Where backs of units will be exposed in unfinished rooms, provide smooth backs, free from glaze. Where backs of units will receive plaster, provide scored, combed, or otherwise roughened backs.
- b. Provide unit surfaces, to receive mortar, reasonably free from glaze and suitable for receiving mortar.
- c. Provide tile for fire rated walls with the percent of solid required

for that rating.

#### 2.2.2.6 Salvaged Brick

Use salvaged bricks and other masonry units in place of new bricks or masonry units as indicated. When using salvaged brick, select salvaged exterior face bricks from exterior locations.

Provide salvaged bricks that meet standards of new bricks otherwise used in application, and cleaned of all mortar prior to use. Submit documentation certifying products are from salvaged/recovered sources. Indicate relative dollar value of salvaged content products to total dollar value of products included in project.

#### 2.2.2.7 Flue Linings and Thimbles

Provide units that comply with ASTM C315, and are free from fractures. Provide sizes and shapes as indicated.

#### 2.2.3 Concrete Units

##### 2.2.3.1 Aggregates

Test lightweight aggregates, and blends of lightweight and heavier aggregates in proportions used in producing the units, for stain-producing iron compounds in accordance with ASTM C641, visual classification method. Do not incorporate aggregates for which the iron stain deposited on the filter paper exceeds the "light stain" classification.

Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates.

##### 2.2.3.2 Concrete Masonry Units (CMU)

###### 2.2.3.2.1 Cement

Use only cement that has a low alkali content and is of one brand.

###### 2.2.3.2.2 Recycled Content

Units may contain post-consumer or post-industrial recycled content.

###### 2.2.3.2.3 Size

Unit Size shall be specified to the project requirements.

###### 2.2.3.2.4 Surfaces

Unless otherwise noted, provide units with exposed surfaces that are smooth and of uniform texture.

###### 2.2.3.2.5 Weather Exposure

Provide concrete masonry units with water-repellant admixture added during manufacture where units will be exposed to weather.

###### 2.2.3.2.6 Unit Types

- a. Hollow Load-Bearing Units: **ASTM C90**, lightweight or normal weight. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.
- b. Hollow Non-Load-Bearing Units: **ASTM C129**, lightweight or normal weight. Load-bearing units may be provided in lieu of non-load-bearing units.
- c. Solid Load-Bearing Units: **ASTM C90**, lightweight or normal weight units. Provide solid units as indicated.

2.2.3.2.7 Jamb Units

Provide jamb units of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

Provide sash jamb units with a 3/4 by 3/4 inch groove near the center at end of each unit.

2.2.3.3 Architectural Units

Provide architectural units with patterned face shell: fluted, vertical scored, orsplit ribbed as specified in project requirements.

Provide units that are integrally colored during manufacture, with color as indicated.

2.2.3.4 Patterned, Decorative Screen Units

Provide patterned, decorative screen units that conform to **ASTM C90**. Provide units that have uniform through-the-wall pattern, color, and texture.

2.2.3.5 Fire-Rated Concrete Masonry Units

For indicated fire-rated construction, provide concrete masonry units of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated by linear interpolation based on the percent by dry-rodded volume of each aggregate used in manufacturing the units.

TABLE I FIRE-RATED CONCRETE MASONRY UNITS							
Aggregate Type	Minimum Equivalent Thickness for Fire-Resistance Rating, inch						
	1/2 hour	3/4 hour	1 hour	1-1/2 hour	2 hours	3 hours	4 hours
Calcareous or siliceous gravel (other than limestone)	2.0	2.4	2.8	3.6	4.2	5.3	6.2
Limestone, cinders, or air-cooled slag	1.9	2.3	2.7	3.4	4.0	5.0	5.9

TABLE I FIRE-RATED CONCRETE MASONRY UNITS							
Aggregate Type	Minimum Equivalent Thickness for Fire-Resistance Rating, inch						
Expanded clay, expanded shale, or expanded slate	1.8	2.2	2.6	3.3	3.6	4.4	5.1
Expanded slag or pumice	1.5	1.9	2.1	2.7	3.2	4.0	4.7

Determine equivalent thickness in accordance with [ACI 216.1](#). Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; include the thickness of plaster or brick or other material in the assembly in determining the equivalent thickness. Submit calculation results.

#### 2.2.3.6 Prefaced Concrete Masonry Units

Prefaced concrete masonry units may be provided in lieu of ceramic glazed structural clay facing tile units. Where prefaced concrete masonry units are provided, concrete masonry unit backing may be omitted when the nominal thickness of the prefaced concrete masonry units is the same as the total indicated nominal thickness of the facing tile plus the backing.

- a. Provide prefaced concrete masonry units conforming to [ASTM C744](#) using masonry units conforming to [ASTM C90](#), with the facing turned over the edges and ends of the unit at least  $3/8$  inch in the direction of the thickness of the unit to form a lip at least  $1/16$  inch thick. Limit variation in color and texture to that in the approved sample.
- b. Provide all shapes and sized for a complete installation. Use bullnose units along sills and caps and at vertical external corners including door jambs, window jambs, and other such openings with a bullnose radius of 1 inch. Cove base units to meet finished floor surfaces where ceramic tile floor occurs.

#### 2.2.3.7 Concrete Brick

##### 2.2.3.7.1 Common Concrete Brick

Provide common concrete brick conforming to [ASTM C55](#). Common concrete brick may be used where necessary for filling out in concrete masonry unit construction.

##### 2.2.3.7.2 Concrete Brick for Facing

Provide concrete brick for exposed applications that conforms to [ASTM C1634](#). Submit samples as specified.

##### 2.2.3.7.3 Sand-Lime Brick

Provide calcium-silicate (sand-lime) that conforms to [ASTM C73](#), Grade SW, approximately  $3-5/8$  inches thick,  $2-1/4$  inches high, and 8 inches long or modular, with smooth surfaces and natural color.

#### 2.2.4 Precast Concrete Units



#### 2.2.4.1 General

- a. Provide precast concrete trim, lintels, copings, splashblocks and sills that are factory-made units in a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, provide precast concrete with minimum 4,000 psi compressive strength, conforming to Section 03 30 00 CAST-IN-PLACE CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and with reinforcement required for handling of the units. Maintain minimum clearance of 3/4 inch between reinforcement and faces of units.
- b. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, either damp-cure for 24 hours or steam-cure and then age under cover for 28 days or longer. In precast concrete members weighing over 80 pounds provide built-in loops of galvanized wire or other approved provisions for lifting and anchoring.
- c. Fabricate units with beds and joints at right angles to the face, with sharp true arises and with drip grooves on the underside where units overhang walls. Form exposed-to-view surfaces free of surface voids, spalls, cracks, and chipped or broken edges and with uniform appearance and color. Unless otherwise specified, provide units with a smooth dense finish.
- d. Prior to installation, wet and inspect each unit for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.
- e. Submit specified factory certificates.
- f. Provide architectural cast stone masonry trim, copings, heads, and sills that are manufactured in a plant by a producer regularly engaged in producing cast stone. Provide cast stone units that comply with ASTM C1364. Submit test reports and three exemplars of the same cast stone product installed in similar projects in similar climatic conditions.

#### 2.2.4.2 Precast Concrete Lintels

Provide precast concrete lintels, unless otherwise shown, of a thickness equal to the wall and reinforced with minimum two No. 4 bars for the full length. Provide top and bottom bars for lintels over 36 inches in length. Provide at least 8 inches bearing at each end. Label the top of lintels and clearly mark each lintel to show location in the structure. Design reinforced lintels in conformance with ACI 318 for flexural and shear strength, using concrete with a minimum 28 day compressive strength of 4,000 psi. Limit lintel deflection due to dead plus live load to L/600 or 0.3 inches.

#### 2.2.4.3 Precast Concrete Sills and Copings

Cast sills and copings washes. For windows having mullions, cast sills in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. Roughen the ends of sills, except a 3/4 inch wide margin at exposed surfaces, for bond. Provide rounded nosings on treads of door sills. Reinforce sills with not less than two No. 4 bars.

### 2.2.5 DIMENSION STONE UNITS

Provide dimension stone for trim, sills, lintels, and copings cut to the design shown and conforming to:

Limestone	ASTM C586	Standard buff color with a smooth machine finish free from tool marks
Sandstone	ASTM C616/C616M	Standard grade, buff, gray, or buff brown, with a smooth finish free from clay pits and tool marks
Granite	ASTM C616/C615M	Commercial grade of medium or moderately coarse grain, with a light or medium gray or light pink color

Provide a smooth machine finish on washes, 4-cut finish on treads, and 6-cut or equivalent machine finish on other exposed surfaces. Except when supported by a steel member, provide lintels 4 inches or more in thickness from face to back edge and of the depth required to support the masonry over the opening. Fabricate stone with beds and joints at right angles to the face, and with sharp, true arises. Provide copings and sills with washes, and where overhanging the walls, with drips cut on the underside. Submit samples as specified.

## 2.3 EQUIPMENT

### 2.3.1 Vibrators

Maintain at least one spare vibrator on site at all times.

### 2.3.2 Grout Pumps

Pumping through aluminum tubes is not permitted.

## 2.4 MATERIALS

### 2.4.1 Mortar Materials

#### 2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270.

#### 2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

#### 2.4.1.3 Colored Mortar

Use mortar pigment that conforms to ASTM C979/C979M. Add pigment to mortar to produce a uniform color as required. Furnish pigments in accurately pre-measured and packaged units that can be added to a measured amount of cementitious materials or supply pigments via preblended cementitious materials or dry mortar mix.

- a. In masonry cement or mortar cement, do not exceed 5 percent of cement weight for mineral oxide pigment; do not exceed 1 percent of cement weight for carbon black pigment.
- b. In cement-lime mortar mix, do not exceed 10 percent of cementitious materials' weight for mineral oxide pigment; do not exceed 2 percent of cementitious materials' weight for carbon black pigment.

#### 2.4.1.4 Admixtures for Masonry Mortar

In cold weather, use a non-chloride based accelerating admixture that conforms to [ASTM C1384](#), unless Type III portland cement is used in the mortar.

In showers and kitchens, use mortar that contains a water-repellent admixture that conforms to [ASTM C1384](#). Provide a water-repellent admixture, conforming to [ASTM C1384](#) and of the same brand and manufacturer as the block's integral water-repellent, in the mortar used to place concrete masonry units that have an integral water-repellent admixture.

#### 2.4.1.5 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by [ASTM C270](#).

### 2.4.2 Grout and Ready-Mix Grout Materials

#### 2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by [ASTM C476](#).

#### 2.4.2.2 Admixtures for Grout

Water-reducing admixtures that conform to [ASTM C494/C494M](#) Type F or G and viscosity-modifying admixtures that conform to [ASTM C494/C494M](#) Type S are permitted for use in grout. Other admixtures require approval by the Contracting Officer.

In cold weather, a non-chloride based accelerating admixture may be used subject to approval by the Contracting Officer; use accelerating admixture that is non-corrosive and conforms to [ASTM C494/C494M](#), Type C.

#### 2.4.2.3 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by [ASTM C476](#).

### 2.5 MORTAR AND GROUT MIXES

#### 2.5.1 Mortar Mix

- a. Provide mortar Type N, S, or M as specified.
- b. Use [ASTM C270](#) Type S cement-lime mortar or mortar cement mortar for seismic-force-resisting elements indicated.
- c. Provide mortar that conforms to [ASTM C270](#). Use Type M mortar for foundation walls, basement walls, and in piers.

- d. Provide Type N or S mortar for non-load-bearing, non-shear-wall interior masonry.
- e. Provide approved commercial fire clay mortar or refractory cement (calcium-aluminate) mortar for fire brick and flue liners.
- f. For field-batched mortar, measure component materials by volume. Use measuring boxes for materials that do not come in packages, such as sand, for consistent batching. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar unless approved by the Contracting Officer. Maintain workability of mortar by remixing or retempering. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.
- g. For preblended mortar, follow manufacturer's mixing instructions.

#### 2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to [ASTM C476](#). Use conventional grout with a slump between [8 and 11 inches](#). Use self-consolidating grout with slump flow of [24 to 30 inches](#) and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of [2000 psi](#) in 28 days, as tested in accordance with [ASTM C1019](#). Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to [ASTM C476](#).

### 2.6 ACCESSORIES

#### 2.6.1 Grout Barriers

Grout barriers for vertical cores that consist of fine mesh wire, fiberglass, or expanded metal.

#### 2.6.2 [Anchors, Ties, and Bar Positioners](#)

##### 2.6.2.1 General

- a. Fabricate anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of [5/8 inch](#) mortar cover from each face of masonry.
- b. Fabricate steel wire anchors and ties from wire conforming to [ASTM A1064/A1064M](#) and hot-dip galvanize in accordance with [ASTM A153/A153M](#).
- c. Fabricate joint reinforcement in conformance with [ASTM A951/A951M](#). Hot dip galvanize joint reinforcement in exterior walls and in interior walls exposed to moist environment in conformance with [ASTM A153/A153M](#). Galvanize joint reinforcement in other interior walls in conformance with [ASTM A641/A641M](#); coordinate with paragraph JOINT REINFORCEMENT below.
- d. Fabricate sheet metal anchors and ties in conformance with [ASTM A1008/A1008M](#). Hot dip galvanize sheet metal anchors and ties in exterior walls and in interior walls exposed to moist environment in

compliance with [ASTM A153/A153M](#) Class B. Galvanize sheet metal anchors and ties in other interior walls in compliance with [ASTM A653/A653M](#), Coating Designation G60.

- e. Submit two anchors, ties and bar positioners of each type used, as samples.

#### 2.6.2.2 Wire Mesh Anchors

Provide wire mesh anchors of [1/4 inch](#) mesh galvanized hardware cloth, conforming to [ASTM A185/A185M](#), with length not less than [12 inches](#), at intersections of interior non-bearing masonry walls.

#### 2.6.2.3 Wall Ties for Multi-Wythe Masonry Construction

Provide rectangular-shaped wall ties, fabricated of hot-dipped galvanized [W1.7](#) diameter steel wire. Provide rectangular wall ties no less than [4 inches](#) wide.

Provide adjustable type wall ties, if approved for use, that consist of two essentially U-shaped elements fabricated of minimum [W2.8](#) diameter steel wire or pintle type ties that are inserted to eyes of horizontal joint reinforcement, hot-dip galvanized. Provide adjustable ties with double pintle legs and allows a maximum offset of [1-1/4 inch](#) between each element of the tie and maximum distance between connecting parts no more than [1/16 inch](#). Form the pintle and eye elements so that both can be in the same plane. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT.

#### 2.6.2.4 Dovetail Anchors

Provide dovetail anchors of [3/16 inch](#) diameter steel wire, triangular shaped, and attached to a [12 gauge](#) or heavier steel dovetail section. Use these anchors to connect the exterior masonry wythe as it passes over the face of concrete columns, beams, or walls. Fill cells immediately above and below these anchors unless solid units are used. Furnish dovetail slots, which are specified to be installed by others, in accordance with Section [03 30 00](#) CAST-IN-PLACE CONCRETE.

#### 2.6.2.5 Adjustable Anchors

##### 2.6.2.5.1 Anchorage to Structural Steel

Provide hot-dip galvanized adjustable anchors for connecting masonry walls to the structural steel frame. Provide zinc-rich paint for touching up paint after welding galvanized anchors to structural steel.

##### 2.6.2.5.2 Anchorage of Veneer to Light Gauge Steel or Concrete Backing

Use one of the following types of adjustable anchors to connect veneer to light gauge steel or concrete backing:

- a. sheet metal at least [7/8 inch](#) wide, [0.06 inch](#) thick, and with corrugations having a wavelength of [0.3 to 0.5 inch](#) and an amplitude of [0.06 to 0.10 inch](#) or bent, notched or punched to provide equivalent performance;
- b. wire anchors of minimum size [W1.7](#) with ends bent to form a minimum [2 inches](#) extension and without drips;

c. or wire pintle anchors used in conjunction with joint reinforcement.

Do not exceed  $1/16$  inch clearance between connecting parts of the tie. Assemble adjustable anchors to prevent disengagement. Provide pintle anchors with one or more pintle legs of wire size W2.8 and an offset not exceeding  $1-1/4$  inch.

#### 2.6.2.6 Veneer Anchor Screws

Provide screws for attachment of veneer anchors to cold-formed steel framing members of size as required by design to provide the needed pullout load capacity but not less than No. 12. Provide length of screws such that the screws penetrate the holding member by not less than  $5/8$  inch.

#### 2.6.2.7 Bar Positioners

Factory-fabricate bar positioners, used to prevent displacement of reinforcing bars during the course of construction, from 9 gauge steel wire or equivalent, and hot-dip galvanized. Bar positioners must be suitable for intended use and be corrosion resistant steel. Bar positioners not fully contained within the wythe must be hot-dip galvanized.

#### 2.6.3 Joint Reinforcement

Factory fabricate joint reinforcement in conformance with ASTM A951/A951M, welded construction. Provide ladder type joint reinforcement, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units and with all wires a minimum of 9 gauge. Size joint reinforcement to provide a minimum of  $5/8$  inch cover from each face. Space crosswires not more than 16 inches. Provide joint reinforcement for straight runs in flat sections not less than 10 feet long. Provide joint reinforcement with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

#### 2.6.4 Reinforcing Steel Bars

Provide reinforcing steel bars and rods conforming to ASTM A615/A615M or ASTM A996/A996M, Grade 60.

#### 2.6.5 Concrete Masonry Control Joint Keys

Provide control joint keys of a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D2000 M2AA-805 with a minimum durometer hardness of 80 or polyvinyl chloride conforming to ASTM D2287 Type PVC 654-4 with a minimum durometer hardness of 85. Form the control joint key with a solid shear section not less than  $5/8$  inch thick and  $3/8$  inch thick flanges, with a tolerance of plus or minus  $1/16$  inch, to fit neatly, but without forcing, in masonry unit jamb sash grooves.

#### 2.6.6 Clay Masonry Expansion-Joint Materials

Provide backer rod and sealant, adequate to accommodate joint compression and extension equal to 50 percent of the width of the joint. Provide the

backer rod of compressible rod stock of closed cell polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Provide sealant in conformance with Section 07 92 00 JOINT SEALANTS with a maximum volatile organic compound (VOC) content of 600 grams/liter.

Submit one piece of each type of material used.

#### 2.6.7 Through Wall Flashing and Weeps

##### 2.6.7.1 General

Provide coated copper, copper or stainless steel sheet, self-adhesive rubberized sheet, or reinforced membrane sheet flashing except that flashing indicated to terminate in reglets must be metal or coated-metal flashing and except that the material must be one which is not adversely affected by dampproofing material.

##### 2.6.7.2 Coated-Copper Flashing

Provide 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, asphalt impregnated kraft paper or polyethylene sheets.

##### 2.6.7.3 Copper or Stainless Steel Flashing

Provide copper sheet, complying with ASTM B370, minimum 16 ounce weight; or stainless steel, ASTM A167, Type 304 or 316, 0.015 inch thick, No. 2D finish.

##### 2.6.7.4 Rubberized Flashing

Provide self-adhesive rubberized asphalt sheet flashing consisting of 32-mil thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 8-mil thick, high density, cross-laminated polyethylene film to produce an overall thickness of 40 mils. Provide rubberized, asphalt-based mastic and surface conditioner that are each approved by flashing manufacturer for use with flashing material.

##### 2.6.7.5 Weep Ventilators

Provide weep ventilators that are prefabricated from stainless steel or plastic. Provide inserts with grill or louver-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of insects, and with a rectangular closure strip to prevent mortar droppings from clogging the opening. Provide ventilators with compressible flanges to fit in a standard 3/8 inch wide mortar joint and with height equal to the nominal height of the unit.

##### 2.6.7.6 Single-Wythe Exterior Wall CMU Flashing System

In single-wythe exterior CMU walls, provide a system of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. For exterior CMU walls, provide a flashing/weep system in open cores that do not receive grout. Cell flashing pans are to have integral weep spouts built into mortar bed joints that extend into the cell to prevent clogging with mortar.

##### 2.6.7.7 Metal Drip Edge

Provide stainless steel drip edge, 15-mil thick, hemmed edges, with down-turned drip at the outside edge and upturned dam at the inside edge for use with membrane flashings.

#### 2.6.8 RIGID BOARD-TYPE INSULATION

Provide rigid board-type insulation as specified in Section 07 21 13 BOARD AND BLOCK INSULATION.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Prior to start of work, verify the applicable conditions as set forth in TMS MSJC, inspection.

#### 3.2 PREPARATION

##### 3.2.1 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

##### 3.2.2 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

##### 3.2.3 Concrete Surfaces

Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

##### 3.2.4 Shelf Angles

Adjust shelf angles as required to keep the masonry level and at the proper elevation.

##### 3.2.5 Bracing

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by OSHA and local codes and submit bracing calculations, sealed by a registered professional engineer. Do not remove bracing in less than 10 days.

#### 3.3 ERECTION

##### 3.3.1 General

- a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in the indicated bond pattern. Lay facing courses level with back-up courses, unless the use of adjustable ties has been approved in which



case the tolerances is plus or minus 1/2 inch. Adjust each unit to its final position while mortar is still soft and has plastic consistency.

- b. Remove and clean units that have been disturbed after the mortar has stiffened, and relay with fresh mortar. Keep air spaces, cavities, chases, expansion joints, and spaces to be grouted free from mortar and other debris. Select units to be used in exposed masonry surfaces from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.
- c. When necessary to temporarily discontinue the work, step (rack) back the masonry for joining when work resumes. Tothing may be used only when specifically approved by the Contracting Officer. Before resuming work, remove loose mortar and thoroughly clean the exposed joint. Cover the top of walls subjected to rain or snow with nonstaining waterproof covering or membrane when work is not in process. Extend the covering a minimum of 610 mm 2 feet down on each side of the wall and hold securely in place.
- d. Ensure that units being laid and surfaces to receive units are free of water film and frost. Lay solid units in a nonfurrowed full bed of mortar. Bevel mortar for veneer wythes and slope down toward the cavity side. Shove units into place so that the vertical joints are tight. Completely fill vertical joints between solid units with mortar, except where indicated at control, expansion, and isolation joints. Place hollow units so that mortar extends to the depth of the face shell at heads and beds, unless otherwise indicated. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Provide means to prevent mortar from dropping into the space below or clean grout spaces prior to grouting.
- e. In multi-wythe construction with collar joints no more than 3/4 inch wide, bring up the inner wythe not more than 16 inches ahead of the outer wythe. Fill collar joints with mortar during the laying of the facing wythe, and do not lag the laying of the facing wythe by back-buttering each unit as it is laid.

#### 3.3.1.1 Jointing

Tool mortar joints when the mortar is thumbprint hard. Tool horizontal joints after tooling vertical joints. Brush mortar joints to remove loose and excess mortar.

##### 3.3.1.1.1 Tooled Joints

Tool mortar joints in exposed exterior and interior masonry surfaces concave, using a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint. No exterior joints are to be left un-tooled.

##### 3.3.1.1.2 Flush Joints

Flush cut mortar joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas. Finish flush cut joints by cutting off the mortar flush with the face of the wall. Point joints in unparged masonry walls below grade tight. For architectural units, such as fluted units, completely fill both the head and bed joints and flush cut.

### 3.3.1.1.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, rake joints between frames and abutting masonry walls to a depth of  $3/8$  inch. On the exterior side of exterior frames, rake joints between frames and abutting masonry walls to a depth of  $3/8$  inch.

### 3.3.1.1.4 Joint Widths

- a. Construct brick masonry with mortar joint widths equal to the difference between the specified and nominal dimensions of the unit, within tolerances permitted by TMS MSJC.
- b. Provide  $3/8$  inch wide mortar joints in concrete masonry, except for prefaced concrete masonry units.
- c. Provide  $3/8$  inch wide mortar joints on unfaced side of prefaced concrete masonry units and not less than  $3/16$  inch nor more than  $1/4$  inch wide on prefaced side.
- d. Maintain mortar joint widths within tolerances permitted by TMS MSJC

### 3.3.1.2 Cutting and Fitting

Use full units of the proper size wherever possible, in lieu of cut units. Locate cut units where they would have the least impact on the architectural aesthetic goals of the facility. Perform cutting and fitting, including that required to accommodate the work of others, by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Before being placed in the work, dry wet-cut units to the same surface-dry appearance as uncut units being laid in the wall. Provide cut edges that are clean, true and sharp.

- a. Carefully make openings in the masonry so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Provide reinforced masonry lintels above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.
- b. Do not reduce masonry units in size by more than one-third in height and one-half in length. Do not locate cut products at ends of walls, corners, and other openings.

### 3.3.1.3 Unfinished Work

Rack back unfinished work for joining with new work. Tothing may be resorted to only when specifically approved by the Contracting Officer. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

### 3.3.1.4 Clay Masonry Expansion Joints

Provide clay masonry expansion joints as indicated. Construct by filling with a compressible foam pad. Ensure that no mortar or other noncompressible materials are within the joint. Install backer rod and sealant in accordance with Section 07 92 00 JOINT SEALANTS.

### 3.3.1.5 Control Joints

Provide control joints in concrete masonry as indicated. Construct by using sash jamb units with control joint key. Form a continuous vertical joint at control joint locations, including through bond beams, by utilizing half blocks in alternating courses on each side of the joint. Interrupt the control joint key in courses containing continuous bond beam reinforcement.

Where mortar was placed in the joint, rake both faces of the control joints to a depth of  $3/4$  inch. Install backer rod and sealant on both faces in accordance with Section 07 92 00 JOINT SEALANTS.

### 3.3.1.6 Decorative Architectural Units

Place decorative masonry units with the patterned face shell properly aligned in the completed wall.

## 3.3.2 Clay or Shale Brick Masonry

### 3.3.2.1 Brick Placement

Blend all brick at the jobsite from several cubes to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable. Lay brick facing with the better face exposed. Lay brick in running bond with each course bonded at corners, unless otherwise indicated. Lay molded brick with the frog side down. Do not lay brick that is cored, recessed, or has other deformations in a manner that allows those deformations to be exposed to view; lay 100 percent solid units in these areas. Completely fill head and bed joints of solid units with mortar. Lay hollow units with mortar joints as specified for concrete masonry units.

Place exterior face of salvaged bricks towards the exterior.

### 3.3.2.2 Wetting of Units

Wet clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface in conformance with ASTM C67/C67M. Ensure that each unit is nearly saturated when wetted but surface dry when laid.

Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

### 3.3.2.3 Brick Sills

Lay brick on edge, slope not less than  $3/4$  inch downward to the outside, and project not less than  $1/2$  inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

### 3.3.2.4 Reinforced Brick Walls

Provide two wythes of brick separated by a continuous space filled with grout and reinforced as indicated. Bevel mortar beds away from grout space to prevent projection into grout space when bricks are shoved in place.

Deeply furrowed bed joints will not be permitted. Lay exterior wythe of brick to the height of each grout pour in advance of interior wythe. Clean grout space and set reinforcing before laying interior wythe. Provide metal ties to prevent spreading of the wythes and to maintain vertical alignment of walls. Place reinforcement and grout in accordance with paragraph BAR REINFORCEMENT INSTALLATION and paragraph PLACING GROUT in this Section.

### 3.3.2.5 Partitions

- a. Construct partitions continuous from floor to underside of floor or roof deck where shown. Fill openings in firewalls around joists and other structural members as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level. Construct an isolation joint in the intersection between partitions and structural or exterior walls.
- b. Tie interior partitions having 4 inch nominal thickness units to intersecting partitions of 4 inch units, 5 inches into partitions of 6 inch units, and 7 inches into partitions of 8 inch or thicker units. Fill cells within vertical plane of ties solid with grout for full height of partition or solid masonry units may be used. Tie interior partitions over 4 inches thick together with joint reinforcement. Provide joint reinforcement with prefabricated pieces at corners and intersections of partitions.
- c. Double-Faced Bases or Partitions: Construct double-faced clay unit bases and partitions of two-unit construction. Bond units by overlapping from opposite faces of the wall, 2 inches for 6 inch thick partitions and 4 inches for 8 inch thick or greater. A single wythe prefaced concrete masonry base or partition may be made with double faced units.

### 3.3.3 Anchored Veneer Construction

- a. Construct exterior masonry wythes to the thickness indicated. Provide a minimum 1 inch air space behind the masonry veneer. Provide means to ensure that the cavity space and flashings are kept clean of mortar droppings and other loose debris. Maintain chases and raked-out joints free from mortar and debris.
- b. Place masonry in bond pattern as required. For stack bond, place longitudinal reinforcement, consisting of at least one continuous hot-dip galvanized W 1.7 (9gauge) steel wire, in the veneer wythe.
- c. For veneer over stud framing, do not install veneer until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the backing. Take extreme care to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Repair or replace portions of the moisture barrier and flashing that are damaged prior to completion of the veneer. Provide a continuous cavity as indicated.
- d. For veneer with a masonry backup wythe, lay up both the inner and the outer wythes together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, install through-wall flashings with the exterior wythe, securing the top edge of the flashing with a termination bar and

sealant, or protect flashings that are installed with the interior wythe from damage until they are fully enclosed in the wall.

- e. Provide anchors (ties) to connect the veneer to its backing in sufficient quantity to comply with the following requirements: maximum wall area per anchor (tie) of 2.67 sf, and maximum vertical spacing of 24 inches, and maximum horizontal spacing of 32 inches on center. Provide additional anchors around openings larger than 16 inch in either direction. Space anchors around perimeter of opening at a maximum of 3 feet on center. Place anchors within 12 inches of openings. Anchors with drips are not permitted.
- f. With solid units, embed anchors in mortar joint and extend into the veneer a minimum of 1-1/2 inch, with at least 5/8 inch mortar cover to the outside face.
- g. With hollow units, embed anchors in mortar or grout and extend into the veneer a minimum of 1-1/2 inch, with at least 5/8 inch mortar or grout cover to outside face.

#### 3.3.4 Composite Walls

Tie masonry wythes together with joint reinforcement or with unit wall ties. Embed wall ties at least 1-1/2 inch into mortar of solid units and at least 1/2 inch into the mortar of the outer face shell of hollow units. Provide at least one tie every 2.67 square feet for wire size W1.7 and at least one tie every 4.50 square feet for wire size W2.8. Space ties at a maximum of 36 inches horizontally and 24 inches vertically. Do not cross expansion joints or control joints with ties. Fill collar joints between masonry facing and masonry backup solidly with grout.

#### 3.3.5 Reinforced, Single Wythe Concrete Masonry Units Walls

##### 3.3.5.1 Concrete Masonry Unit Placement

- a. Fully bed units used to form piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout in mortar under both face shells and webs. Provide mortar beds under both face shells for other units. Mortar head joints for a distance in from the face of the unit not less than the thickness of the face shell.
- b. Solidly grout foundation walls below grade.
- c. Stiffen double walls at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of each wall within the double wall. Adequately reinforce walls and partitions for support of wall-hung plumbing fixtures when chair carriers are not specified.
- d. Submit drawings showing elevations of walls exposed to view and indicating the location of all cut CMU products.

##### 3.3.5.2 Preparation for Reinforcement

Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be grouted. Remove mortar protrusions extending 1/2 inch or more into cells before placing grout. Position reinforcing bars

accurately as indicated before placing grout. Where vertical reinforcement occurs, fill cores solid with grout in accordance with paragraph PLACING GROUT in this Section.

### 3.3.6 Cavity Walls (Multi-Wythe Noncomposite Walls)

Provide a continuous cavity as indicated. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. Dampproof cavity face of interior wythe in accordance with Section 07 11 13 BITUMINOUS DAMPPROOFING.

Securely tie the two wythes together with horizontal joint reinforcement, or provide ties to connect the masonry wythes in sufficient quantity to comply with the following requirements: maximum wall area per tie of 2.67 sf, and maximum vertical spacing of 16 inches, and maximum horizontal spacing of 24 inches. Provide additional ties around openings larger than 16 inches in either direction. Space ties around perimeter of opening at a maximum of 3 feet on center. Place ties within 12 inches of openings. Ties with drips are not permitted.

### 3.3.7 ANCHORAGE

#### 3.3.7.1 Anchorage to Concrete

Anchor masonry to the face of concrete columns, beams, or walls with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

#### 3.3.7.2 Anchorage to Structural Steel

Anchor masonry to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

#### 3.3.7.3 Anchorage at Intersecting Walls

Provide wire mesh anchors at maximum 16 inches spacing at intersections of interior non-bearing masonry walls.

Anchor structural masonry walls with reinforced bond beams spaced no more than 10 feet on center, horizontal joint reinforcement spaced no more than 2 feet on center, or strap anchors of minimum size 1/4 inch x 1-1/2 inch x 28 inches including 2 inch) 90 degree bends at each end to form U or Z shape at maximum spacing 48 inches, grouted into the wall, unless the drawings indicate a movement joint at the intersection.

### 3.3.8 Lintels

#### 3.3.8.1 Masonry Lintels

Construct masonry lintels with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated. Extend lintel reinforcement beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Support reinforcing bars in place prior to grouting and locate 1/2 inch above the bottom inside surface of the lintel unit.

#### 3.3.8.2 Precast Concrete and Steel Lintels

Provide precast concrete and steel lintels as shown on the Drawings. Set lintels in a full bed of mortar with faces plumb and true. Provide steel and precast lintels with a minimum bearing length of 8 inches unless otherwise indicated. In partially grouted masonry, provide fully grouted units under the full lintel bearing length, unless otherwise indicated.

### 3.3.9 Sills and Copings

Set sills and copings in a full bed of mortar with faces plumb and true. Slope sills and copings to drain water. Mechanically anchor copings and sills longer than 4 feet as indicated.

## 3.4 INSTALLATION

### 3.4.1 Bar Reinforcement Installation

#### 3.4.1.1 Preparation

Submit detail drawings showing bar splice locations. Identify bent bars on a bending diagram and reference and locate such bars on the drawings. Show wall dimensions, bar clearances, and wall openings. Utilize bending details that conform to the requirements of ACI SP-66. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, resubmit the approved shop drawings with the additional openings shown along with the proposed changes. Clearly highlight location of these additional openings. Provide wall elevation drawings with minimum scale of 1/4 inch per foot. Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, and other coatings that might destroy or reduce its bond prior to placing grout. Do not use bars with kinks or bends not shown on the approved shop drawings. Place reinforcement prior to grouting. Unless otherwise indicated, extend vertical wall reinforcement to within 2 inches of tops of walls.

#### 3.4.1.2 Positioning Bars

- a. Accurately place vertical bars within the cells at the positions indicated on the drawings. Maintain a minimum clearance of 1/2 inch between the bars and masonry units. Provide minimum clearance between parallel bars of 1/2 inch between the bars and masonry units for coarse grout and a minimum clearance of 1/4 inch between the bars and masonry units for fine grout. Provide minimum clearance between parallel bars of 1 inch or one diameter of the reinforcement, whichever is greater. Vertical reinforcement may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement or by other means to prevent displacement beyond permitted tolerances. As masonry work progresses, secure vertical reinforcement to prevent displacement beyond allowable tolerances.
- b. Wire column and pilaster lateral ties in position around the vertical reinforcing bars. Place lateral ties in contact with the vertical

reinforcement and do not place in horizontal mortar bed joints.

- c. Position horizontal reinforcing bars as indicated. Stagger splices in adjacent horizontal bars, unless otherwise indicated.
- d. Form splices by lapping bars as indicated. Do not cut, bend or eliminate reinforcing bars. Foundation dowel bars may be field-bent when permitted by **TMS MSJC**.

#### 3.4.1.3 Splices of Bar Reinforcement

Lap splice reinforcing bars as indicated. When used, provide welded or mechanical connections that develop at least 125 percent of the specified yield strength of the reinforcement.

#### 3.4.2 Placing Grout

##### 3.4.2.1 General

Fill cells containing reinforcing bars with grout. Solidly grout hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces. Solidly grout cells under lintel bearings on each side of openings for full height of openings. Solidly grout walls below grade, lintels, and bond beams. Units other than open end units may require grouting each course to preclude voids in the units.

Discard site-mixed grout that is not placed within 1-1/2 hours after water is first added to the batch or when the specified slump is not met without adding water after initial mixing. Discard ready-mixed grout that does not meet the specified slump without adding water other than water that was added at the time of initial discharge. Allow sufficient time between grout lifts to preclude displacement or cracking of face shells of masonry units. Provide a grout shear key between lifts when grouting is delayed and the lower lift loses plasticity. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, tear down the wall and rebuild.

##### 3.4.2.2 Vertical Grout Barriers for Multi-Wythe Composite Walls

In multi-wythe composite walls, provide grout barriers in the collar joint not more than **30 feet** apart, or as required, to limit the horizontal flow of grout for each pour.

##### 3.4.2.3 Horizontal Grout Barriers

Embed horizontal grout barriers in mortar below cells of hollow units receiving grout.

##### 3.4.2.4 Grout Holes and Cleanouts

###### 3.4.2.4.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than **16 inches** on centers where grouting of hollow unit masonry is indicated. Form such openings not less than **4 inches** in diameter or **3 by 4 inches** in horizontal dimensions. Upon completion of



grouting operations, plug and finish grouting holes to match surrounding surfaces.

#### 3.4.2.4.2 Cleanouts for Hollow Unit Masonry Construction

For hollow masonry units, provide cleanout holes at the bottom of every grout pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet 4 inches. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout.

Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Provide cleanouts not less than 3 by 3 inch by cutting openings in one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Do not cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

#### 3.4.2.4.3 Cleanouts for Multi-Wythe Composite Masonry Construction

Provide cleanouts for construction of walls that incorporate a grout filled cavity between solid masonry wythes, provide cleanouts at the bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

#### 3.4.2.5 Grout Placement

A grout pour is the total height of masonry to be grouted prior to erection of additional masonry. A grout lift is an increment of grout placement within a grout pour. A grout pour is filled by one or more lifts of grout.

- a. Lay masonry to the top of a pour permitted by TMS MSJC Table 7, based on the size of the grout space and the type of grout. Prior to grouting, remove masonry protrusions that extend 1/2 inch or more into cells or spaces to be grouted. Provide grout holes and cleanouts in accordance with paragraph GROUT HOLES AND CLEANOUTS above when the grout pour height exceeds 5 feet 4 inches. Hold reinforcement, bolts, and embedded connections rigidly in position before grouting is started. Do not prewet concrete masonry units.
- b. Place grout using a hand bucket, concrete hopper, or grout pump to fill the grout space without segregation of aggregate. Operate grout pumps to produce a continuous stream of grout without air pockets, segregation, or contamination.
- c. If the masonry has cured at least 4 hours, grout slump is maintained between 10 to 11 inches, and no intermediate reinforced bond beams are placed between the top and bottom of the pour height, place conventional grout in lifts not exceeding 12 feet 8 inches. For the same curing and slump conditions but with intermediate bond beams, limit conventional grout lift to the bottom of the lowest bond beam that is more than 5 feet 4 inches above the bottom of the lift, but do not exceed 12 feet 8 inches. If masonry has not cured at least 4 hours

or grout slump is not maintained between 10 to 11 inches, place conventional grout in lifts not exceeding 5 feet 4 inches.

- d. Consolidate conventional grout lift and reconsolidate after initial settlement before placing next lift. For grout pours that are 12 inches or less in height, consolidate and reconsolidate grout by mechanical vibration or puddling. For grout pours that are greater than 12 inches in height, consolidate and reconsolidate grout by mechanical vibration. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation. If previous lift is not permitted to set, dip vibrator into previous lift. Do not insert vibrators into lower lifts that are in a semi-solidified state. If lower lift sets prior to placement of subsequent lift, form a grout key by terminating grout a minimum of 1-1/2 inch below a mortar joint. Vibrate each vertical cell containing reinforcement in partially grouted masonry. Do not form grout keys within beams.
- e. If the masonry has cured 4 hours, place self-consolidating grout (SCG) in lifts not exceeding the pour height. If masonry has not cured for at least 4 hours, place SCG in lifts not exceeding 5 feet 4 inches. Do not mechanically consolidate self-consolidating grout. Place self-consolidating grout in accordance with manufacturer's recommendations.
- f. Upon completion of each day's grouting, remove waste materials and debris from the equipment, and dispose of outside the masonry.

#### 3.4.3 Joint Reinforcement Installation

Install joint reinforcement at 16 inches on center unless otherwise indicated. Lap joint reinforcement not less than 6 inches. Install prefabricated sections at corners and wall intersections. Place the longitudinal wires of joint reinforcement in mortar beds to provide not less than 5/8 inch cover to either face of the unit.

#### 3.4.4 Bond Beams

Reinforce and grout bond beams as indicated and as described in paragraphs above. Install grout barriers under bond beam units to retain the grout as required, unless wall is fully grouted or solid bottom units are used. For high lift grouting in partially grouted masonry, provide grout retaining material on the top of bond beams to prevent upward flow of grout. Ensure that reinforcement is continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated.

#### 3.4.5 Flashing and Weeps

- a. Install through-wall flashing at obstructions in the cavity and where indicated on Drawings. Ensure continuity of the flashing at laps and inside and outside corners by splicing in a manner approved by the flashing manufacturer. Ensure that the top edge of the flashing is sealed by turning the flashing 1/2 inch into the mortar bed joint of backup masonry. Terminate the horizontal leg of the flashing by extending the sheet metal 1/2 inch beyond the outside face of masonry and turning downward with a hemmed drip. Provide sealant below the drip edge of through-wall flashing.

- b. Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated. Provide weeps of weep ventilators. Locate weeps not more than 24 inches on centers in mortar joints of the exterior wythe directly on the horizontal leg of through-wall flashing over foundations, bond beams, and any other horizontal interruptions of the cavity. Place weep holes perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Other methods may be used for providing weeps when spacing is reduced to 16 inches on center and approved by the Contracting Officer. Maintain weeps free of mortar and other obstructions.

### 3.5 APPLICATION

#### 3.5.1 Insulation

Insulate cavity walls (multi-wythe noncomposite masonry walls), by installing board-type insulation on the cavity side of the inner wythe. Apply board type insulation directly to the masonry or thru-wall flashing with adhesive. Neatly fit insulation between obstructions without impaling insulation on ties or anchors. Apply insulation in parallel courses with vertical joints breaking midway over the course below and in moderate contact with adjoining units without forcing. Cut to fit neatly against adjoining surfaces. Tape or seal the joints between the boards.

#### 3.5.2 Interface with Other Products

##### 3.5.2.1 Built-In Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout, unless otherwise indicated.

##### 3.5.2.2 Door and Window Frame Joints

On the exposed interior and exterior sides of exterior frames, rake joints between frames and abutting masonry walls to a depth of 3/8 inch.

##### 3.5.2.3 Bearing Plates

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Provide bedding mortar and non-shrink grout as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

#### 3.5.3 Tolerances

Lay masonry plumb, true to line, with courses level within the tolerances of TMS MSJC, Article 3.3 F.

### 3.6 FIELD QUALITY CONTROL

#### 3.6.1 Tests

##### 3.6.1.1 Field Testing of Mortar

Perform mortar testing at the following frequency: 1 time per day for first three consecutive days, followed by once weekly. For each required mortar test, provide a minimum of three mortar samples. Perform initial mortar testing prior to construction for comparison purposes during construction.

Prepare and test mortar samples for mortar aggregate ratio in accordance with ASTM C780 Appendix A4.

#### 3.6.1.2 Field Testing of Grout

- a. Perform grout testing at the following frequency: 1 time per day for three consecutive days, followed by once weekly. For each required grout property to be evaluated, provide a minimum of three specimens.
- b. Sample and test conventional and self-consolidating grout for compressive strength and temperature in accordance with ASTM C1019.
- c. Evaluate slump in conventional grout in accordance with ASTM C1019.
- d. Evaluate slump flow and visual stability index of self-consolidating grout in accordance with ASTM C1611/C1611M.

#### 3.6.1.3 Single-Wythe Masonry Wall Water Penetration Test

Prior to start of field construction of the single-wythe concrete masonry wall, perform masonry wall water penetration test on mock-up wall assemblies consisting of the identical design, materials, mix, and construction methods as the actual wall construction and in accordance with ASTM E514/E514M. Prepare a minimum of three specimens and cure for minimum 28 days prior to testing. Construct panels by the same methods, processes, and applications to be used on the project's construction site. Spray test for 6 hours on each specimen. If water is visible on back of test panels during the test and areas of dampness on the backside of the test panels do not exceed 25 percent of the wall area, the panels will be considered to have passed. Dampness is defined as any area of surface darkening or discoloration due to moisture penetration or accumulation below the observed surface.

Construct additional test panels for each failed test performed until three test panels pass the test. Factors that can affect test performance include materials, mixing, and quality of application and workmanship. Materials, mixing, and methods adjustments may be necessary in order to provide construction that passes the water penetration test. Document and record the test specimen construction materials and application and provide written test report in accordance with ASTM E514/E514M, supplemented by a detailed discussion of the specifics of test panel construction, application methods and processes used, quality of construction, and any variances or deviations that may have occurred between test panels during test panel construction. For failed test panels, identify in the supplemental report the variances, deficiencies or flaws that contributed to test panel failure and itemize the precautions to be taken in field construction of the masonry wall to prevent similar deficiencies and assure the wall construction replicates test panel conditions that pass the water penetration test. Submit the complete, certified test report, including supplemental report, to the Contracting Officer prior to start of single-wythe concrete masonry wall construction. Significant changes to materials, proportions, or construction techniques from those used in the

passing water penetration test are grounds for performing new tests, at the discretion of the Contracting Officer.

### 3.6.2 Special Inspection

Perform special inspections and testing in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

## 3.7 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs and splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, rake out defects in joints of masonry to be exposed or painted, fill with mortar, and tool to match existing joints. Immediately after grout work is completed, remove scum and stains that have percolated through the masonry work using a low pressure stream of water and a stiff bristled brush. Do not clean masonry surfaces, other than removing excess surface mortar, until mortar in joints has hardened. Leave masonry surfaces clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Do not use metal tools and metal brushes for cleaning.

### 3.7.1 Dry-Brushing Concrete Masonry

Dry brush exposed concrete masonry surfaces at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

### 3.7.2 Clay Brick Surfaces

Clean exposed clay brick masonry surfaces to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. Perform cleaning in accordance with the approved cleaning procedure demonstrated on the mockup.

After cleaning, examine the sample panel of similar material for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected. Water-soak exposed masonry surfaces and then clean with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay brick manufacturer and manufacturer of the cleaning product. Apply the solution with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Use proprietary cleaning agents in conformance with the cleaning product manufacturer's printed recommendations. Remove efflorescence in conformance with the brick manufacturer's recommendations.

## 3.8 CLOSE-OUT TAKE-BACK PROGRAM

Collect information from manufacturer for take-back program options. Set aside masonry units, full and partial to be returned to manufacturer for recycling into new product. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

## 3.9 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane to protect from moisture intrusion when work is not in progress. Continue covering the top of the unfinished walls until the wall is waterproofed with a complete roof or parapet system. Extend covering a minimum of 2 feet down on each side of the wall and hold securely in place. Before starting or resuming work, clean top surface of masonry in place of loose mortar and foreign material.

-- End of Section --

## SECTION 05 05 23.16

## STRUCTURAL WELDING

08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2016) Specification for Structural Steel Buildings

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

AWS D14.4/D14.4M (2012) Specification for Welded Joints for Machinery and Equipment

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

AWS Z49.1 (2021) Safety in Welding and Cutting and Allied Processes

## ASTM INTERNATIONAL (ASTM)

ASTM E165/E165M (2018) Standard Practice for Liquid Penetrant Examination for General Industry

ASTM E709 (2021) Standard Guide for Magnetic Particle Testing

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding Quality Assurance Plan; G

SD-03 Product Data

Welding Procedure Qualifications; G

Welder, Welding Operator, and Tacker Qualification

Previous Qualifications

Pre-Qualified Procedures; G

Welding Electrodes and Rods

SD-06 Test Reports

Nondestructive Testing

Weld Inspection Log

SD-07 Certificates

Certified Welding Procedure Specifications (WPS)

Certified Brazing Procedure Specifications (BPS)

Certified Procedure Qualification Records (PQR)

Certified Welder Performance Qualifications (WPQ)

Certified Brazer Performance Qualifications (BPQ)

Certified Welding Inspector

Nondestructive Testing Personnel

### 1.3 QUALITY ASSURANCE

Except for pre-qualified (in accordance with [AWS D1.1/D1.1M](#)) and previously qualified procedures, each Contractor performing welding must record in detail and qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Conform [welding procedure qualifications](#) to [AWS D1.1/D1.1M](#) and to the specifications in this section. Submit for approval copies of the welding procedure specification and the procedure qualification records for each type of welding being performed. Submission of the welder, welding operator, or tacker qualification test records is also required. Approval of any procedure, however, does not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the specified requirements. Submit this information on the forms in Annex M of [AWS D1.1/D1.1M](#). Individually identify and clearly reference on the detail drawings and erection drawings all welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between



this specification and AWS D1.1/D1.1M, this specification governs.

### 1.3.1 General Requirements

Fabricate work in an AISC Certified Fabrication Plant, Category BU. Erect work by an AISC Certified Erector, Category CSE.

a. For Structural Projects, provide documentation of the following:

- (1) Component Thickness 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.1/D1.1M.
- (2) Component Thickness Less than 1/8 inch: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.3/D1.3M.
- (3) Reinforcing Steel: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.4/D1.4M.

b. For other applications, provide documentation of the following:

- (1) Submit two copies of the Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR) to the Contracting Officer for review.
- (2) Submit two copies of the Certified Welder Performance Qualifications (WPQ) and Certified Brazer Performance Qualifications (BPQ) to the Contracting Officer for review within fourteen calendar days prior to any employee welding on the project material.
- (3) Machinery: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.4/D14.4M.

### 1.3.2 Previous Qualifications

Welding procedures previously qualified by test in accordance with AWS D1.1/D1.1M, may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

### 1.3.3 Pre-qualified Procedures

Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.

### 1.3.4 Welder, Welding Operator, and Tacker Qualification

Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used within the applicable essential variables for welder qualification.

#### 1.3.4.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

- a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

#### 1.3.4.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, submit the names and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

#### 1.3.4.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

- a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.
- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance all records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified.
- d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he/she is qualified, unless there is some specific

reason to question the tacker's ability or there has been a gap greater than 6 months since he/she last used the process. In such a case, the tacker is required to pass the prescribed tack welding test.

#### 1.3.5 Inspector Qualification

Submit certificates indicating that [certified welding inspectors](#) meet the requirements of [AWS QC1](#). Submit qualifications for [nondestructive testing personnel](#) in accordance with the requirements of [ANSI/ASNT CP-189](#) for Levels I or II in the applicable nondestructive testing method. Level I inspectors must have direct supervision of a Level II inspector.

#### 1.3.6 Symbols and Safety

Use symbols in accordance with [AWS A2.4](#), unless otherwise indicated. Follow safe welding practices and safety precautions during welding in conformance with [AWS Z49.1](#).

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Conform the design of welded connections to [AISC 360](#), unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Perform all testing at or near the work site. Maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

##### 2.1.1 Pre-erection Conference

Hold a pre-erection conference prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (submitted for all welding, including welding done using pre-qualified procedures). Mandatory attendance is required by all Contractor's welding production and inspection personnel and appropriate Government personnel. Include as items for discussion: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and nondestructive testing; welding schedule; and other items deemed necessary by the attendees.

#### 2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator. Use [the appropriate welding electrode per the task requirements](#). Provide welding equipment and materials that comply with the applicable requirements of [AWS D1.1/D1.1M](#). Submit product data on [welding electrodes and rods](#).

### PART 3 EXECUTION

### 3.1 WELDING OPERATIONS

#### 3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of [AWS D1.1/D1.1M](#) and [AISC 360](#). When [AWS D1.1/D1.1M](#) and the [AISC 360](#) specification conflict, the requirements of [AWS D1.1/D1.1M](#) govern.

#### 3.1.2 Identification

Identify all welds in one of the following ways:

- a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.
- b. Identify all work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 3 foot intervals. Identification with die stamps or electric etchers is not allowed.

### 3.2 QUALITY CONTROL

Perform testing using an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual [Weld Inspection Log](#). Test 50% of CJP welds using ultrasonic testing per Table 6.2 or 6.3 of [AWS D1.1/D1.1M](#). Randomly test 50% of all PJP and fillet welds or as indicated by magnetic particle or dye penetrant testing. Verify the welds conform to paragraph STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of [AWS D1.1/D1.1M](#), [ASTM E165/E165M](#), and [ASTM E709](#). Submit a [Welding Quality Assurance Plan](#) and records of tests and inspections.

### 3.3 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of [AWS D1.1/D1.1M](#) and the contract drawings. Submit all records of [nondestructive testing](#).

#### 3.3.1 Nondestructive Testing

The welding is subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop do not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment. Any indication of a defect is regarded as a defect, unless re-evaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present. Submit all records of nondestructive testing in accordance with paragraph STANDARDS OF

ACCEPTANCE.

### 3.3.2 Destructive Tests

Make all repairs when metallographic specimens are removed from any part of a structure. Employ only qualified welders or welding operators, and use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

### 3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

### 3.5 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of [AWS D1.1/D1.1M](#) and the specifications. Repair all defects in accordance with the approved procedures. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

-- End of Section --

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## SECTION 05 12 00

STRUCTURAL STEEL  
08/18, CHG 2: 05/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 207	(2016; R 2017) Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components
AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 341	(2016) Seismic Provisions for Structural Steel Buildings
AISC 360	(2016) Specification for Structural Steel Buildings
AISC DESIGN GUIDE 10	(1997) Erection Bracing of Low-Rise Structural Steel Buildings

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel
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## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B46.1	(2020) Surface Texture, Surface Roughness, Waviness and Lay
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## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS QC1	(2016) Specification for AWS Certification of Welding Inspectors

## ASTM INTERNATIONAL (ASTM)

ASTM A6/A6M	(2021) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A29/A29M	(2020) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2020) Standard Specification for Structural Steel Shapes
ASTM B695	(2021) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM F436/F436M	(2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F844	(2019) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F959/F959M	(2017a) Standard Specification for Compressible-Washer-Type Direct Tension



Indicators for Use with Structural Fasteners, Inch and Metric Series

- ASTM F1136/F1136M (2011) Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
- ASTM F1554 (2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- ASTM F2329/F2329M (2015) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
- ASTM F2833 (2011; R 2017) Standard Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type
- ASTM F3125/F3125M (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

- CMAA 70 (2015) Specification for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC PA 1 (2016) Shop, Field, and Maintenance Coating of Metals
- SSPC Paint 20 (2019) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)
- SSPC Paint 29 (2002; E 2004) Zinc Dust Sacrificial Primer, Performance-Based
- SSPC SP 3 (2018) Power Tool Cleaning
- SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

- UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR Part 1926, Subpart R Steel Erection

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Erection and Erection Bracing Drawings; G

## SD-02 Shop Drawings

Fabrication Drawings Including Details of Connections; G

## SD-03 Product Data

Shop Primer

Welding Electrodes and Rods

Direct Tension Indicator Washers

Non-Shrink Grout

Tension Control Bolts

Recycled Content for Structural Steel; S

Recycled Content for Structural Steel Tubing; S

Recycled Content for Steel Pipe; S

## SD-05 Design Data

Design Calculations for Steel Connections; G

## SD-06 Test Reports

Class B Coating

Bolts, Nuts, and Washers

Weld Inspection Reports

Direct Tension Indicator Washer Inspection Reports

Bolt Testing Reports

## SD-07 Certificates

Steel

Bolts, Nuts, and Washers

Galvanizing

AISC Structural Steel Fabricator Quality Certification

AISC Structural Steel Erector Quality Certification

Welding Procedures and Qualifications

Welding Electrodes and Rods

Certified Welding Inspector

NDT Technician

Welding Procedure Specifications (WPS)

Overhead, Top Running Crane Rail Beam

### 1.3 AISC QUALITY CERTIFICATION

Work must be fabricated by an AISC Certified Structural Steel Fabricator, in accordance with [AISC 207](#), Category BU. Submit [AISC Structural Steel Fabricator quality certification](#).

Work must be erected by an AISC Structural Steel Certified Erector, in accordance with [AISC 207](#), Category CSE. Submit [AISC Structural Steel erector quality certification](#).

### 1.4 SEISMIC PROVISIONS

Provide the structural steel system in accordance with [AISC 341](#), Chapter J as amended by [UFC 3-301-01](#).

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Preconstruction Submittals

##### 1.5.1.1 [Erection and Erection Bracing Drawings](#)

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing. The erection drawings must conform to [AISC 303](#). Erection drawings must be reviewed, stamped and sealed by a registered professional engineer.

#### 1.5.2 Fabrication Drawing Requirements

Submit [fabrication drawings](#) for approval prior to fabrication. Prepare in accordance with [AISC 303](#), [AISC 326](#) and [AISC 325](#). Fabrication drawings must not be reproductions of contract drawings. Sign and seal fabrication drawings by a registered professional engineer. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use [AWS A2.4](#) standard welding symbols. Clearly highlight any deviations from the details shown on the contract drawings highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

#### 1.5.3 Certifications

##### 1.5.3.1 [Welding Procedures and Qualifications](#)

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Conform to all requirements specified in [AWS D1.1/D1.1M](#).

#### 1.5.3.2 Overhead, Top Running Crane Rail Beam

Submit written field survey results for overhead, top running crane rail beam verifying tolerance requirements per [CMAA 70](#).

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer/galvanizing, complete and ready for use. Provide structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing in accordance with [AISC 303](#), [AISC 360](#), and [UFC 3-301-01](#) except as modified in this contract.

#### 2.2 STEEL

##### 2.2.1 Structural Steel

Wide flange and WT shapes, [ASTM A992/A992M](#). Angles, Channels and Plates, [ASTM A36/A36M](#). Provide structural steel containing a minimum of 80 percent recycled content. Submit data identifying percentage of [recycled content for structural steel](#).

##### 2.2.2 Structural Steel Tubing

[ASTM A500/A500M](#), Grade C. Provide structural steel tubing containing a minimum of 25 percent recycled content. Submit data identifying percentage of [recycled content for structural steel tubing](#).

##### 2.2.3 Steel Pipe

[ASTM A53/A53M](#), Type E or S, Grade B, weight class STD (Standard) or as indicated. Provide steel pipe containing a minimum of 50 percent recycled content. Submit data identifying percentage of [recycled content for steel pipe](#).

#### 2.3 BOLTS, NUTS, AND WASHERS

Submit the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

##### 2.3.1 Common Grade Bolts

###### 2.3.1.1 Bolts

[ASTM A307](#), Grade A, plain finish hot dipped zinc coating. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

## 2.3.1.2 Nuts

ASTM A563, Grade A, heavy hex style.

## 2.3.1.3 Washers

ASTM F844.

## 2.3.2 High-Strength Bolts

High strength bolts and nuts must be shipped together in the same shipping container. Fasteners indicated to be galvanized shall be tested by the supplier to show that the galvanized nut with the supplied lubricant provided may be rotated from the snug tight condition well in excess of the rotation required for pretensioned installation without stripping. The supplier shall supply nuts that have been lubricated and tested with the supplied bolts.

## 2.3.2.1 Bolts

ASTM F3125/F3125M, Grade A325M A325, Type 1 Heavy Hex Head Style, plain finish hot dipped zinc coating, unless required otherwise.

## 2.3.2.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

## 2.3.2.3 Direct Tension Indicator Washers

ASTM F959/F959M. Submit product data for direct tension indicator washers.

## 2.3.2.4 Washers

ASTM F436/F436M, plain carbon steel.

## 2.3.3 Tension Control Bolts

ASTM F3125/F3125M, Grade F1852 unless requirements specify otherwise, Type 1, twistoff style assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon steel nuts, and hardened carbon steel washers. Assembly finish must be plain. Submit product data for tension control bolts.

## 2.3.4 Foundation Anchorage

## 2.3.4.1 Anchor Rods

ASTM F1554 Gr 36, 55, or 105, Class 1A or 2A, dependant on project specific requirements.

## 2.3.4.2 Anchor Nuts

ASTM A563, Grade A, hex style.

## 2.3.4.3 Anchor Washers

ASTM F844.

#### 2.3.4.4 Anchor Plate Washers

ASTM A36/A36M.

### 2.4 STRUCTURAL STEEL ACCESSORIES

#### 2.4.1 Welding Electrodes and Rods

AWS D1.1/D1.1M. Submit product data for welding electrodes and rods.

#### 2.4.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage. Grout must be nonmetallic. Submit product data for non-shrink grout.

#### 2.4.3 Welded Shear Stud Connectors

ASTM A29/A29M, Grades 1010 through 1020. AWS D1.1/D1.1M, Table 7.1, Type B.

### 2.5 GALVANIZING

ASTM F2329/F2329M, ASTM F1136/F1136M, ASTM F2833 or ASTM B695 for threaded parts or ASTM A123/A123M for structural steel members, as applicable, unless specified otherwise galvanize after fabrication where practicable.

### 2.6 FABRICATION

Fabrication must be in accordance with the applicable provisions of AISC 325. Fabrication and assembly must be done in the shop to the greatest extent possible. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member.

Compression joints depending on contact bearing must have a surface roughness not in excess of 500 micro inch as determined by ASME B46.1, and ends must be square within the tolerances for milled ends specified in ASTM A6/A6M.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

#### 2.6.1 Markings

Prior to erection, identify members by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections must be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations. Affix embossed tags to hot-dipped galvanized members.

#### 2.6.2 Shop Primer

SSPC Paint 20 or SSPC Paint 29, (zinc rich primer). Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, surfaces to receive epoxy coatings, surfaces designed as part of a composite steel concrete section, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking and shear studs are to be welded). If

flash rusting occurs, re-clean the surface prior to application of primer. Apply primer to a minimum dry film thickness of 2.0 mil. Submit shop primer product data.

Prime slip critical surfaces with a Class B coating in accordance with AISC 325. Submit test report for Class B coating.

Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer. Repair damaged primed surfaces with an additional coat of primer.

#### 2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

#### 2.6.3 Fireproofing and Epoxy Coated Surfaces

Clean and prepare surfaces to receive sprayed-on fireproofing epoxy coatings in accordance with the manufacturer's recommendations, and as specified in Section 07 81 00 SPRAY-APPLIED FIREPROOFING.

#### 2.7 DRAINAGE HOLES

Drill adequate drainage holes to eliminate water traps. Hole diameter must be 1/2 inch and location indicated on the detail drawings. Hole size and locations must not affect the structural integrity.

### PART 3 EXECUTION

#### 3.1 ERECTION

- a. Erection of structural steel, except as indicated in item b. below, must be in accordance with the applicable provisions of AISC 325, AISC 303 and 29 CFR Part 1926, Subpart R.
- b. For low-rise structural steel buildings ( 60 feet tall or less and a maximum of 2 stories), erect the structure in accordance with AISC DESIGN GUIDE 10.

After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

##### 3.1.1 STORAGE

Store the material out of contact with the ground in such manner and location as to minimize deterioration.

#### 3.2 CONNECTIONS

Except as modified in this section, design connections indicated in accordance with AISC 360. Build connections into existing work. Do not

tighten anchor bolts set in concrete with impact torque wrenches. Holes must not be cut or enlarged by burning. Bolts, nuts, and washers must be clean of dirt and rust, and lubricated immediately prior to installation.

### 3.2.1 Common Grade Bolts

Tighten [ASTM A307](#) bolts to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

### 3.2.2 High-Strength Bolts

Provide direct tension indicator washers in all [ASTM F3125/F3125M](#), Grade [A325](#) and Grade [A490](#) bolted connections. Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, fully tension bolts, progressing from the most rigid part of a connection to the free edges.

Fastener components shall be protected from dirt and moisture in closed containers at the site of the installation. Fastener components that are not incorporated into the work shall be returned to protected storage at the end of the work shift.

#### 3.2.2.1 Installation of Direct Tension Indicator Washers (DTIW)

Where possible, install the DTIW under the bolt head and tighten the nut. If the DTIW is installed adjacent to the turned element, provide a flat washer between the DTIW and nut when the nut is turned for tightening, and between the DTIW and bolt head when the bolt head is turned for tightening. In addition to the DTIW, provide flat washers under both the bolt head and nut when [ASTM F3125/F3125M](#), Grade [A490](#) bolts are used.

### 3.2.3 Tension Control Bolts

Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, fully tension bolts, progressing from the most rigid part of a connection to the free edges.

## 3.3 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors is not permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

## 3.4 WELDING

Welding must be in accordance with [AWS D1.1/D1.1M](#). Grind exposed welds smooth as indicated. Provide [AWS D1.1/D1.1M](#) qualified welders, welding operators, and tackers.

Develop and submit the [Welding Procedure Specifications \(WPS\)](#) for all welding, including welding done using prequalified procedures. Submit for approval all WPS, whether prequalified or qualified by testing.

### 3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.



### 3.5 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

#### 3.5.1 Field Priming

Field prime steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat must be cleaned and primed with paint of the same quality as that used for the shop coat.

### 3.6 GALVANIZING REPAIR

Repair damage to galvanized coatings using [ASTM A780/A780M](#) zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

### 3.7 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. Notify the Contracting Officer in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of the inspection.

#### 3.7.1 Welds

##### 3.7.1.1 Visual Inspection

[AWS D1.1/D1.1M](#). Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. A [Certified Welding Inspector](#) must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Submit certificates indicating that certified welding inspectors meet the requirements of [AWS QC1](#).

##### 3.7.1.2 Nondestructive Testing

Nondestructive testing must be in accordance with [AWS D1.1/D1.1M](#). Ultrasonic testing must be performed in accordance with Table 6.2 or 6.3 of [AWS D1.1/D1.1M](#). Test locations must be selected by the Contracting Officer. All personnel performing NDT must be certified in accordance with [ANSI/ASNT CP-189](#) in the method of testing being performed. Submit certificates showing compliance with [ANSI/ASNT CP-189](#) for all [NDT technicians](#). If more than 20 percent of welds made by a welder contain defects identified by testing, then all groove welds made by that welder must be tested by ultrasonic testing, and all fillet welds made by that welder must be inspected by magnetic particle testing (MT) or dye penetrant testing (PT) as approved by the Contracting Officer. When groove welds made by an individual welder are required to be tested, magnetic particle or dye penetrant testing may be used only in areas inaccessible to ultrasonic testing. Retest all repaired areas. Submit [weld inspection reports](#).

Testing frequency: Provide the following types and number of tests:

<u>Test Type</u>	<u>Number of Tests</u>
Ultrasonic	50 percent of CJP Welds
Magnetic Particle	50 percent of PJP and Fillet Welds
Dye Penetrant	50 percent of PJP and Fillet Welds

### 3.7.2 Direct Tension Indicator Washers

#### 3.7.2.1 Direct Tension Indicator Washer Compression

Test direct tension indicator washers in place to verify that they have been compressed sufficiently to provide the 0.015 inch gap, as required by [ASTM F959/F959M](#). Submit [direct tension indicator washer inspection reports](#).

### 3.7.3 High-Strength Bolts

#### 3.7.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in [AISC 360](#), depending on bolt size and grade. The bolt tension must be developed by tightening the nut. A representative of the manufacturer or supplier must be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements. Submit [bolt testing reports](#).

#### 3.7.3.2 Inspection

Inspection procedures must be in accordance with [AISC 360](#). Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

#### 3.7.3.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. Provide the required access for the Government to perform the tests. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations must be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, must be tested at the Contractor's expense. Retest new bolts after installation at the Contractor's expense.

### 3.7.4 Inspection and Testing of Steel Stud Welding

Perform verification inspection and testing of steel stud welding conforming to the requirements of AWS D1.1/D1.1M, Stud Welding Clause. The Contracting Officer will serve as the verification inspector. Bend test studs that do not show a full 360 degree weld flash or have been repaired by welding as required by AWS D1.1/D1.1M, Stud Welding Clause. Studs that crack under testing in the weld, base metal or shank will be rejected and replaced by the Contractor at no additional cost.

-- End of Section --

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## SECTION 05 21 00

STEEL JOIST FRAMING  
05/15, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN WELDING SOCIETY (AWS)

**AWS D1.1/D1.1M** (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

**ASTM A36/A36M** (2019) Standard Specification for Carbon Structural Steel

## INTERNATIONAL CODE COUNCIL (ICC)

**ICC IBC** (2018) International Building Code

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

**SSPC PA 1** (2016) Shop, Field, and Maintenance Coating of Metals

**SSPC Paint 15** (1999; E 2004) Steel Joist Shop Primer/Metal Building Primer

**SSPC SP 2** (2018) Hand Tool Cleaning

## STEEL JOIST INSTITUTE (SJI)

**SJI COMPOSITE JOISTS** (2007; Supplement 1 2010) Standard Specifications for Composite Steel Joist Catalog

**SJI LOAD TABLES** (2020) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders - 45th Edition

**SJI MANUAL** (2009) 80 Years of Open Web Steel Joist Construction

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**29 CFR 1926** Safety and Health Regulations for Construction

**29 CFR 1926.756** Steel Erection; Beams and Columns

**29 CFR 1926.757** Steel Erection; Open Web Steel Joists

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Welder Qualification

### SD-02 Shop Drawings

Steel Joist Framing; G[, [\_\_\_\_\_]]

### SD-03 Product Data

Recycled Content Of Steel Products; S

### SD-05 Design Data

Design Calculations; G[, [\_\_\_\_\_]]

### SD-06 Test Reports

Erection Inspection

Welding Inspections

### SD-07 Certificates

Certification of Compliance

## 1.3 QUALITY ASSURANCE

Perform all work in compliance with the requirements set forth in 29 CFR 1926.

### 1.3.1 Drawing Requirements

Submit drawings of [steel joist framing](#) including fabrication, specifications for shop painting, and identification markings of joists [and joist girders]. Show joist type and size, layout in plan, all applicable loads, deflection criteria, and erection details including methods of anchoring, framing at openings, type, size, and location and connections for and spacing of bridging, requirements for field welding, and details of accessories as applicable. [Show profiles for nonstandard joist configurations.][Show steel joist field splice locations and details.]

### 1.3.2 Certification of Compliance

Prior to construction commencement, submit certification for [welder qualification](#), in compliance with [AWS D1.1/D1.1M](#), welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. Submit [certification of compliance](#) for

the following:

[ a. **SJI MANUAL**

] [a][b]. Steel Joist Institute Member Fabricator

[b][c]. **29 CFR 1926**

[c][d]. **29 CFR 1926.757**

[d][e]. Statement from steel joist manufacturer, that work was performed in accordance with approved construction documents and with SJI standard specifications, in accordance with **ICC IBC** Section 1704.2.5.2.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store joists [and joist girders] in a manner to prevent damage affecting their structural integrity. Verify piece count of all joist products upon delivery and inspect all joists products for damage. Report any damage to the joist supplier. Store all items off the ground in a well drained location protected from the weather and easily accessible for inspection and handling. Store joists with top chord down and with joists in a vertical position. Store deep joists horizontally if they were shipped on their sides.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Designate steel joists [and joist girders] on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

### 2.2 STEEL JOISTS [AND JOIST GIRDERS]

Provide steel joists [and joist girders] conforming to **SJI LOAD TABLES**. Design joists designated K, KCS, LH and DLH to support the loads given in the applicable standard load tables of **SJI LOAD TABLES**. Submit **design calculations** for [joist girders,] [special steel joists,] [composite steel joists,] net uplift loads, non-SJI standard details, and field splices. Include cover letter signed and sealed by the joist manufacturer's registered design professional.

#### 2.2.1 Steel Joist Camber

Camber joists [according to **SJI LOAD TABLES**] [as indicated]. [Do not camber joists.]

#### 2.2.2 Special Steel Joists

Provide special joists and connections capable of withstanding the design loads indicated with a live-load deflection less than [L/360] [L/240] for roof joists and L/360 for floor joists.

#### 2.2.3 Steel Joist Substitutes and Outriggers

Provide joist substitutes and outriggers conforming to **SJI LOAD TABLES** with steel angle or channel members.

#### 2.2.4 Composite Steel Joists

Provide composite steel joists conforming to **SJI COMPOSITE JOISTS**.

#### 2.2.5 Joist Girders

Provide joist girders capable of withstanding the design loads indicated with a live-load deflection less than  $[L/360]$   $[L/240]$  for roof girders and  $L/360$  for floor girders. [Where joist girders are part of the lateral load resisting system, design girder for the end moments indicated for wind [and seismic].]

[ Provide holes in top chord members for connecting and securing other construction to the joist girders.]

Camber joist girders [according to **SJI LOAD TABLES**] [as indicated]. [Do not camber joist girders.]

### 2.3 RECYCLED CONTENT

Provide products with an average **recycled content of steel products** of postconsumer recycled content plus one half of preconsumer recycled content not less than [25] [\_\_\_\_\_] percent.

### 2.4 ACCESSORIES AND FITTINGS

#### 2.4.1 Bridging

Provide bridging of material, size, and type required by **SJI LOAD TABLES** for type of joist, chord size, spacing and span. Furnish additional erection bridging if required for stability.

#### 2.4.2 Bearing Plates

Fabricate steel bearing plats from **ASTM A36/A36M** steel of size and thickness indicated.

#### 2.4.3 Ceiling Extensions

Furnish ceiling extensions, either bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within  $1/2$  inch of finished wall surface unless otherwise indicated.

### 2.5 SHOP PAINTING

**SSPC Paint 15**. Shop prime joists, except as modified herein, in accordance with **SSPC PA 1**. Clean joists in accordance with **SSPC SP 2** before priming. [Do not prime joists to receive sprayed-on fireproofing.] If flash rusting occurs, re-clean the surface prior to application of primer. For joists [and joist girders] which require finish painting under Section **09 90 00 PAINTS AND COATINGS**, the primer paint must be compatible with the finish paint.

## PART 3 EXECUTION

### 3.1 ERECTION



Install joists [and joist girders] in conformance with [SJI LOAD TABLES](#) for the joist series indicated, and the requirements of [29 CFR 1926](#) and [29 CFR 1926.757](#) [and [29 CFR 1926.756](#)]. Handle and set joists [and joist girders] avoiding damage to the members. Place the "tag end" of joists as shown on the joists placement plans. Ensure that square-end joists are erected right side up. [Place joists on joist girders in accordance with the joist placement plan, noting that in many instances joist may not need to be placed at a joist girder panel point.] Distribute temporary loads so that joist capacity is not exceeded. Remove damaged joists [and joist girders] from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Do not repair, field modify, or alter any joists [or joist girder] without specific written instructions from the Designer of Record and/or joist manufacturer.

Install and connect bridging concurrently with joist erection, before construction loads are applied. Do not apply loads to bridging. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams. Do not cut away vertical leg of bridging where bridging makes an elevation transition; weld a separate piece of bridging at the transition. Perform all welding in accordance with [AWS D1.1/D1.1M](#).

### [3.2 BEARING PLATES

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Provide bedding mortar and grout as specified in Section [03 30 00](#) CAST-IN-PLACE CONCRETE.

### ]3.3 PAINTING

#### 3.3.1 Touch-Up Painting

After erection of joists [and joist girders], touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

#### [3.3.2 Field Painting

Paint joists [and joist girders] requiring a finish coat in conformance with the requirements of Section [09 90 00](#) PAINTS AND COATINGS.

### ]3.4 VISUAL INSPECTIONS

Perform the following visual inspections:

- a. Verify that all joists are spaced properly.
- b. Verify that there is sufficient joist bearing on steel beams, concrete, and masonry.
- c. Verify all bridging lines are properly spaced and anchored.
- d. Verify that damage has not occurred to the joists [and joist girder] during erection.

- e. Verify the joists are aligned vertically and there is no lateral sweep in the joists.
- f. Where concentrated loads are present on the joists verify that they are located in accordance with the joists placement plan.
- g. Verify welding of bridging and joist seats in accordance with AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors.
- h. Verify proper bolting of diagonal bridging and joist seats where the bolts are snug-tight.

-- End of Section --

## SECTION 05 30 00

## STEEL DECKS

05/15, CHG 2: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (2017) Cold-Formed Steel Design Manual

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780/A780M (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A792/A792M (2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM A1008/A1008M (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM C423 (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM D746 (2014) Standard Test Method for

Brittleness Temperature of Plastics and Elastomers by Impact

- ASTM D1056 (2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
- ASTM D1149 (2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
- ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

- FM APP GUIDE (updated on-line) Approval Guide  
<http://www.approvalguide.com/>
- FM DS 1-28R (1998) Data Sheet: Roof Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC Paint 20 (2019) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

STEEL DECK INSTITUTE (SDI)

- ANSI/SDI C (2017) Standard for Composite Steel Floor Deck - Slabs
- ANSI/SDI NC (2017) Standard for Non-Composite Steel Floor Deck
- ANSI/SDI QA/QC (2017) Standard for Quality Control and Quality Assurance for Installation of Steel Deck
- ANSI/SDI RD (2017) Standard for Steel Roof Deck
- SDI DDM04 (2015; Errata 1-3 2016; Add 1 2015; Add 2 20162006) Diaphragm Design Manual; 4th Edition
- SDI DDP (1987; R 2000) Deck Damage and Penetrations
- SDI MOC3 (2016) Manual of Construction with Steel Deck (3rd Edition)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926 Safety and Health Regulations for Construction

UNDERWRITERS LABORATORIES (UL)

UL 209 (2011; Reprint Aug 2020) UL Standard for Safety Cellular Metal Floor Raceways and Fittings

UL 580 (2006; Reprint Mar 2019) UL Standard for Safety Tests for Uplift Resistance of Roof Assemblies

UL Fire Resistance (2014) Fire Resistance Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Fabrication Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

Accessories

Deck Units

Galvanizing Repair Paint

[ Mechanical Fasteners

]

Touch-Up Paint

Sound Absorbing Materials

Welding Equipment

Welding Rods and Accessories

Recycled Content of Steel Products; S

### SD-04 Samples

Metal Roof Deck Units

Cellular Metal Floor Deck Units

Flexible Closure Strips

Acoustical Material

SD-05 Design Data

Deck Units; G[, [\_\_\_\_\_]]

SD-07 Certificates

Powder-Actuated Tool Operator

Welder Qualifications

Welding Procedures

Fire Safety

Wind Storm Resistance

Manufacturer's Certificate

Stud Manufacture's Certification

Stud Manufacture's Test Reports

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide [manufacturer's certificate](#)s attesting that the decking material meets the specified requirements.

#### 1.3.2 Certification of [Powder-Actuated Tool Operator](#)

Provide manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.

#### 1.3.3 Qualifications for Welding Work

Follow [Welding Procedures](#) of [AWS D1.3/D1.3M](#) for sheet steel and [AWS D1.1/D1.1M](#) for stud welding.

Submit qualified [Welder Qualifications](#) in accordance with [AWS D1.3/D1.3M](#) for sheet steel and [AWS D1.1/D1.1M](#) for stud welding, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. [Test specimens shall be made in the presence of Contracting Officer and shall be tested by an approved testing laboratory at the Contractor's expense.] If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for [Welding Equipment](#) and [Welding Rods and Accessories](#).

### 1.3.4 Regulatory Requirements

#### 1.3.4.1 Fire Safety

Test roof deck as a part of a roof deck construction assembly of the type used for this project, listing as fire classified in the [UL Fire Resistance](#), or listing as Class I construction in the [FM APP GUIDE](#), and so labeled.

#### 1.3.4.2 Wind Storm Resistance

Provide roof construction assembly capable of withstanding a nominal uplift pressure of [60] [90] [\_\_\_\_\_] [pounds per square foot](#) when tested in accordance with the uplift pressure test described in the [FM DS 1-28R](#) or as described in [UL 580](#) and in general compliance with [UFC 3-301-01](#).

#### 1.3.5 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, cant strips, ridge and valley plates, metal closure strips, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

### 1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

#### 1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of [AISI D100](#).

#### 1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

## PART 2 PRODUCTS

### 2.1 DECK UNITS

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

Provide products with an average [recycled content of steel products](#) so postconsumer recycled content plus one half of preconsumer recycled content not less than [25] [\_\_\_\_\_] percent.

### 2.1.1.1 Roof Deck

Conform to [ASTM A792/A792M](#) or [ASTM A1008/A1008M](#) for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of [ [0.0295](#) ] [ [\\_\\_\\_\\_\\_](#) ] inch design thickness or thicker steel [the steel design thickness required by the design drawings] and [shop painted] [galvanized] [painted with an epoxy coating or equivalent applied to prime-coating in accordance with manufacturer's standard] [zinc-coated in conformance with [ASTM A653/A653M](#), Z275 G90 coating class or aluminum-zinc coated in accordance with [ASTM A792/A792M](#) Coating Designation AZM165 AZ55]. Furnish sample of [Metal Roof Deck Units](#) used to illustrate actual cross section dimensions and configurations.

### [2.1.2 Acoustical Roof Deck

Provide a Noise Reduction Coefficient (NRC) rating of not less than [0.70] [ [\\_\\_\\_\\_\\_](#) ], when tested in accordance with [ASTM C423](#). Provide [sound absorbing materials](#) with either [glass fiber in roll or premolded form for acoustical steel deck (noncellular)] [and] [or] [glass fiber rigid strip for acoustical steel deck (cellular)] in accordance with manufacturer's standards.

### ]2.1.3 Composite Deck

[Conform to [ASTM A653/A653M](#) or [ASTM A1008/A1008M](#) for composite deck assembly. Fabricate deck used as the tension reinforcing in composite deck of [ [0.0295](#) ] [ [\\_\\_\\_\\_\\_](#) ] inch design thickness or thicker steel with integrally embossed or raised pattern ribs.] [The steel design thickness required by the design drawings. Zinc-coat in conformance with [ASTM A653/A653M](#), [G60] [G90] coating class.] [Shore composite deck until the concrete has reached [75] [ [\\_\\_\\_\\_\\_](#) ] percent of its specified strength.]

### 2.1.4 Cellular Metal Floor Deck Units

Provide decking as wire raceways conforming to [NFPA 70](#). Conform to [ [ASTM A653/A653M](#), SS, Grade 230, Grade 33]; [[ASTM A1008/A1008M](#) Coated Carbon Steel Sheets, Grade C, 33,000 psi minimum yield strength]; or [ [ASTM A792/A792M](#) Coated Steel Sheets, Grade 33] for formed [cellular] [and] [non-cellular] decking and accessories. Provide nominal thickness of the steel sheets, before galvanizing, a minimum 18-gage for the upper element of the floor deck unit, and a minimum 16-gage for the lower element of the floor deck unit [as required by the design drawings]. [Furnish one sample of each type of Metal Floor Deck Units used to illustrate the actual cross section dimensions and configuration.]

### 2.1.5 Form Deck

Conform to [ASTM A653/A653M](#) or [ASTM A1008/A1008M](#) for deck used as formwork for concrete. Fabricate form deck of [ [0.015](#) ] [ [\\_\\_\\_\\_\\_](#) ] inch design thickness or thicker steel.] [the steel design thickness required by the design drawings.] [Paint with one coat of manufacture's standard paint.] [Zinc-coat in conformance with [ASTM A653/A653M](#), [ Z180 G60] [ Z275 G90] coating class.]

Provide sufficient welds, forming the steel sheets into the cellular floor deck unit, to develop the full horizontal shear at the plane where the steel sheets are joined.



Cellular metal floor deck units must be fluted section cells combined [on a flat plate] [with a matching fluted bottom section] having interlocking type sidelaps. Provide depth, width of unit, number of cells per unit, and width of cells as indicated.

Use panels of maximum possible lengths to minimize end laps. Fabricate deck units in lengths to span 3 or more supports with flush, telescoped, or nested 2 inch laps at ends, and interlocking, or nested side laps, unless otherwise indicated. [Factory apply a standard, phosphatized and painted, baked-on enamel finish to underside of steel decking.] [[Floor] [and] [Roof] deck system design is based on shored construction.]

#### [2.1.6 Non-Composite Vented Form Deck

To ensure positive venting from the underside, provide slotted or perforated steel deck to receive concrete fill, overlay, or a poured concrete deck. Provide deck with side lap venting clips, formed in side lap vents, or vent slots in the corrugation. Vent area shall be at least 0.10 square inch per square foot of roof deck area.

#### ]2.1.7 Length of Deck Units

Provide deck units of sufficient length to span three or more spacings where possible.

#### [2.1.8 Shop Priming

Shop prime accessories and [underside of] deck at the factory after coating. Clean surfaces in accordance with the manufacturer's standard procedure followed by a spray, dip or roller coat of rust-inhibitive primer, oven cured.

#### ]2.1.9 Touch-Up Paint

Provide a high zinc-dust content paint for regalvanizing welds in galvanized steel conforming to ASTM A780/A780M.

Provide touch-up paint for shop-painted units [of the same type used for the shop painting] [\_\_\_\_], and touch-up paint for zinc-coated units of [an approved galvanizing repair paint with a high-zinc dust content] [\_\_\_\_]. Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780/A780M. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

### 2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

#### 2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

#### 2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures

minimum 0.0295 inch thick to close open ends at [exposed edges of floors,] [parapets,] [end walls,] [eaves,] [and] openings through deck.

### 2.2.3 Partition Closures

Provide closures for closing voids above interior walls and partitions that are perpendicular to the direction of the configurations. [Provide rubber, plastic, or sheet steel closures above typical partitions.] [Provide minimum one inch thick soft composition rubber closures above walls and partitions contiguous to acoustical steel deck.] [Provide sheet steel closures above fire-resistant interior walls and partitions located on both sides of wall or partition.] [Provide glass fiber blanket insulation in the space between pairs of closures at acoustical partitions.]

### 2.2.4 Flexible Closure Strips for Roof Decks

Provide strips made of vulcanized, closed-cell, synthetic rubber material specified and premolded to the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking. [Furnish one sample of each type Flexible Closure Strips, 12 inch long.]

Conforming to ASTM D1056, Grade 2A1, with the following additional properties:

Brittleness temperature of minus 40 degrees F when tested in accordance with ASTM D746.

Flammability resistance with a flame spread rating of less than 25 when tested in accordance with ASTM E84.

Resistance to ozone must be "no cracks" after exposure of a sample kept under a surface tensile strain of 25 percent to an ozone concentration of 100 parts per million of air by volume in air for 100 hours at 104 degrees F and tested in accordance with ASTM D1149.

Provide a elastomeric type adhesive as recommended by the manufacturer of the flexible closure strips.

### 2.2.5 Closure Plates for Composite Deck

Support and retain concrete at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Provide metal closures for all openings in composite steel deck 1/4 inch and over.

### 2.2.6 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

### 2.2.7 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, 2 inch wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

Fabricate cover plates for abutting floor deck units from the specified

structural-quality steel sheets not less than nominal 18 gage thick before galvanizing. Provide 6 inch wide cover plates and form to match the contour of the floor deck units.

#### 2.2.8 Roof Sump Pans

Sump pans must be provided for roof drains and must be minimum 0.075 inch thick steel, [flat] [recessed] type. Shape sump pans to meet roof slope by the supplier or by a sheet metal specialist. Provide bearing flanges of sump pans to overlap steel deck a minimum of 3 inch. Shape, size, and reinforce the opening in bottom of the sump pan to receive roof drain.

#### 2.2.9 Column Closures

Sheet metal, minimum 0.0358 inch thick or metal rib lath.

#### 2.2.10 Access Hole Covers

Sheet metal, minimum 0.0474 inch thick.

#### 2.2.11 Hanger

Provide clips or loops for [utility systems] [and] [suspended ceilings] of one or more of the following types:

- a. Lip tabs or integral tabs where noncellular decking or flat plate of cellular section is 0.0474 inch thick or more, and a structural concrete fill is used over deck.
- b. Slots or holes punched in decking for installation of pigtails.
- c. Tabs driven from top side of decking and arranged so as not to pierce electrical cells.
- d. Decking manufacturer's standard as approved by the Contracting Officer.

#### 2.2.12 Shear Connectors

Provide shear connectors in accordance with AWS D1.1/D1.1M headed stud Type B. Submit stud manufacture's certification that the studs delivered conform to the material requirements. Submit stud manufacture's test reports for the last completed in-plant quality control mechanical tests.

#### 2.2.13 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Bend strips to form a 45-degree cant not less than 5 inch wide, with top and bottom flanges a minimum 3 inch wide. Length of strips 10 feet.

#### 2.2.14 Ridge and Valley Plates for Roof Decks

Fabricate plates from the specified structural-quality steel sheets, not less than nominal 0.0358 inch thick before galvanizing. Provide plates of minimum 4-1/2 inch wide and bent to provide tight fitting closures at ridges and valleys. Provide a minimum length of ridge and valley plates of 10 feet.

#### 2.2.15 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

#### 2.2.16 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36/A36M, and hot-dip galvanized in accordance with ASTM A123/A123M.

#### [2.2.17 Sound Absorbing Material

Provide [glass fiber in roll or premolded form for acoustical noncellular steel roof deck] [and] [glass fiber rigid strip for acoustical cellular steel deck] in accordance with the manufacturer's standards. Provide a sample of acoustical material to be used.

#### ]2.2.18 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated fasteners, pneumatically driven fasteners or self-drilling screws, for anchoring the deck to structural supports and adjoining units[ as indicated] [ that are designed to meet the loads indicated].

#### ]2.2.19 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0598 inch other metal accessories, 0.0358 inch unless otherwise indicated.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

#### 3.2 INSTALLATION

Install steel deck units in accordance with 29 CFR 1926, Subpart R - Steel Erection, ANSI/SDI QA/QC, [ANSI/SDI C] [ANSI/SDI NC] [ANSI/SDI RD] [SDI DDM04] and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. [Lap 2 inch] [Butted] deck ends. Do not use unanchored deck units as a work or storage platform. [Do not fill unanchored deck with concrete.] Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage. [ Prepare shoring in position before concrete placement begins in composite or form deck.][ Size cellular

decking provided as electrical raceways to accommodate indicated wiring systems. Chip off burrs and eliminate sharp edges which may damage wiring. Mesh decking panels accurately and place in accordance with [UL 209](#).] [ Neatly fit acoustical material into the rib voids.]

### 3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal  $5/8$  inch diameter puddle welds, [ fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners] as indicated on the design drawings and in accordance with manufacturer's recommended procedure [ and [ANSI/SDI C](#), [ANSI/SDI NC](#) or [ANSI/SDI RD](#)]. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding [or fastening]. [ Anchoring the deck to structural supports with powder-actuated fasteners or pneumatically driven fasteners is prohibited.] Attachment of adjacent deck units by button-punching is prohibited.

#### 3.2.1.1 Welding

Perform welding in accordance with [AWS D1.3/D1.3M](#) using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in [AWS D1.3/D1.3M](#) make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. [Indicate] [Conform to the recommendations of the Steel Deck Institute and the steel deck manufacturer] for location, size, and spacing of fastening. [Do] [Do not] use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of [SDI DDM04](#). [Attach shear connectors as shown and welded as per [AWS D1.1/D1.1M](#) [through the steel deck to the steel member] [directly to the steel member]]. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of [coated finish with zinc-dust paint conforming to [ASTM A780/A780M](#)] [shop [primed] [painted] finish with the manufacturer's standard touch-up paint].

#### [3.2.1.2 Mechanical Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners. [Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool. ] [Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations.] [ Drive screws to properly clamp desk to supporting steel.]

#### ]3.2.1.3 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by welding or screws as indicated.

### 3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with [SDI DDP](#). Reinforce [holes and openings

6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists. ] [Deck manufacturer shall approve holes or openings larger than 6 inch in diameter prior to drilling or cutting. ] [Openings must not interfere with seismic members such as chords and drag struts.]

### 3.2.3 Deck Damage

SDI MOC3, for repair of deck damage.

### 3.2.4 Touch-Up Paint

#### 3.2.4.1 Roof Deck

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

#### 3.2.4.2 Floor Deck

For floor decking installation, wire brush, clean, and touchup paint the scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members. Include welds, weld scars, bruises, and rust spots for scarred areas. Touched up the galvanized surfaces with galvanizing repair paint. Touch up the painted surfaces with paint for the repair of painted surfaces.

### 3.2.5 Accessory Installation

#### 3.2.5.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

#### 3.2.5.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

#### 3.2.5.3 Closures Above Partitions

Provide for closing voids between cells over partitions that are perpendicular to direction of cells. Provide a one-piece closure strip for partitions 4 inch nominal or less in thickness and two-piece closure strips for wider partitions. [Provide sheet metal closures above fire-rated partitions at both sides of partition with space between filled with fiberglass insulation.] [Provide flexible rubber closures above acoustic-rated partitions at both sides of partition with space between filled with blanket insulation.]

#### 3.2.5.4 Cover Plates

[Provide metal cover plates, or joint tape, at joints between cellular decking sheets to be used as electrical raceways.] [Where concrete leakage would be a problem, provide metal cover plates, or joint tape, at joints between decking sheets, cellular or noncellular, to be covered with concrete fill.]

#### [3.2.5.5 Column Closures

Provide for spaces between floor decking and columns which penetrate the deck. Field cut closure plate to fit column in the field and tack weld to decking and columns.

#### ]3.2.5.6 Access Hole Covers

Provide access whole covers to seal holes cut in decking to facilitate welding of the deck to structural supports.

#### 3.2.5.7 Hangers

Provide as indicated to support [utility system] [and] [suspended ceilings]. Space devices [as indicated] [so as to provide one device per 6.25 square feet].

#### [3.2.6 Sound Absorbing Material

Install sound absorbing [glass fiber roll or premolded form, neatly in voids between perforated webs of acoustical noncellular steel deck] [and] [glass fiber rigid strip, in cells of acoustical cellular steel deck]. Keep sound absorbing material dry before, during and after installation.

#### ] [3.2.7 Concrete Work

Prior to placement of concrete, inspect installed decking to ensure that there has been no permanent deflection or other damage to decking. Replace decking which has been damaged or permanently deflected as approved by the Contracting Officer. Place concrete on metal deck in accordance with Construction Practice of ANSI/SDI C or ANSI/SDI NC.

#### ]3.2.8 Preparation of Fire-Proofed Surfaces

Provide deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, galvanized and free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Complete any required cleaning prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

#### 3.3 ROOF SUMP PANS

Place sump pans over openings in roof decking and fusion welded to top surface of roof decking. Do not exceed spacing of welds of 12 inch with not less than one weld at each corner. Field cut opening in the bottom of each roof sump pan to receive the roof drain as part of the work of this section.

#### 3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized

self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

### 3.5 RIDGE AND VALLEY PLATES FOR ROOF DECKS

Provide plates to be fusion welded to top surface of roof decking. Lap end joints a minimum 3 inch. For valley plates, provide endlaps to be in the direction of water flow.

### 3.6 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

### 3.7 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

### 3.8 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

### 3.9 FIELD QUALITY CONTROL

#### 3.9.1 Headed Stud Inspection

In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

- a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
- b. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

#### 3.9.2 Deck Weld Inspection

Visual inspect welds in accordance with AWS D1.3/D1.3M.

#### [3.9.3 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges should not exceed manufacturing and construction tolerances of supporting members. When gap is more than the allowable, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

] -- End of Section --





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## SECTION 05 40 00

## COLD-FORMED METAL FRAMING

05/15, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members

AISI S110 (2007; Suppl 1; Reaffirmed 2012) Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames

AISI S200 (2007) North American Standard for Cold-Formed Steel Framing - General Provision

AISI S201 (2007) North American Standard for Cold-Formed Steel Framing - Product Data

AISI S202 (2011) Code of Standard Practice for Cold-formed Steel Structural Framing

AISI S211 (2007) North American Standard for Cold-Formed Steel Framing - Wall Stud Design

AISI S212 (2007) North American Standard for Cold-Formed Steel Framing - Header Design

AISI S213 (2007; Suppl 1 2009) North American Standard for Cold-Formed Steel Framing - Lateral Design

AISI S214 (2012) North American Standard for Cold-Formed Steel Framing - Truss Design

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding

Code - Steel

AWS D1.3/D1.3M

(2018) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M

(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M

(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307

(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A370

(2021) Standard Test Methods and Definitions for Mechanical Testing of Steel Products

ASTM A653/A653M

(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A1003/A1003M

(2015) Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members

ASTM C955

(2017) Standard Specification for Cold-Formed Steel Structural Framing Members

ASTM C1007

(2020) Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories

ASTM C1513

(2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections

ASTM E119

(2020) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E329

(2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

ASTM E488/E488M

(2022) Standard Test Methods for Strength of Anchors in Concrete Elements

ASTM F1554

(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield

## Strength

ASTM F1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F2329/F2329M	(2015) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IBC	(2018) International Building Code
U.S. DEPARTMENT OF DEFENSE (DOD)	
UFC 3-301-01	(2019, with Change 1, 2022) Structural Engineering

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Framing Components; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Steel Studs, Joists, Tracks, Bracing, Bridging and Accessories

Recycled Content of Steel Products; S

## [ SD-05 Design Data

Metal Framing Calculations; G[, [\_\_\_\_\_]]

## ] SD-07 Certificates

Load-Bearing Cold-Formed Metal Framing

Welds

## 1.3 DELIVERY, STORAGE, AND HANDLING

Steel framing and related accessories shall be stored and handled in accordance with the AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing".

## 1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include[ top and bottom tracks,] bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads.[ Design framing in accordance with [AISI S100](#).][ Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section [09 22 00 SUPPORTS FOR PLASTER AND GYPSUM BOARD](#).][ Metal suspension systems for acoustical ceilings are specified in Section [09 51 00 ACOUSTICAL CEILINGS](#).]

Submit mill certificates or test reports from independent testing agency, qualified in accordance with [ASTM E329](#), showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with [ASTM A370](#).

#### 1.5 MAXIMUM DEFLECTION

Deflections of structural members shall not exceed the more restrictive of the limitations of [ICC IBC](#) and [UFC 3-301-01](#).

[ For scissor roof trusses limit the horizontal deflection at supports to less than [ [1-1/4 inches](#)][\_\_\_\_\_].

#### ]1.6 QUALITY ASSURANCE

- a. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a registered professional engineer.
- b. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to [ASTM E329](#) for testing indicated.
- c. Product Tests: Mill certificates or data from a qualified independent testing agency[, or in-house testing with calibrated test equipment] indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- d. Welding Qualifications: Qualify procedures and personnel according to the following:
  - (1) [AWS D1.1/D1.1M](#), "Structural Welding Code - Steel".
  - (2) [AWS D1.3/D1.3M](#), "Structural Welding Code - Sheet Steel".
- e. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per [ASTM E119](#) by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.
- f. AISI Specifications and Standards: Comply with:
  - (1) [AISI S100](#), "North American Specification for the Design of Cold-Formed Steel Structural Members".
  - (2) [AISI S110](#), "Standard for Seismic Design of Cold-Formed Steel

Structural Systems - Special Bolted Moment Frames".

- (3) **AISI S200**, "North American Standard for Cold-Formed Steel Framing - General Provision".
- (4) **AISI S201**, "North American Standard for Cold-Formed Steel Framing - Product Data".
- (5) **AISI S202**, "Code of Standard Practice for Cold-Formed Steel Structural Framing".
- (6) **AISI S211**, "North American Standard for Cold-Formed Steel Framing - Wall Stud Design".
- (7) **AISI S212**, "North American Standard for Cold-Formed Steel Framing - Header Design".
- (8) **AISI S213**, "North American Standard for Cold-Formed Steel Framing - Lateral Design".
- (9) **AISI S214**, "North American Standard for Cold-Formed Steel Framing - Truss Design".

#### 1.6.1 Drawing Requirements

Submit **framing components** to show sizes, thicknesses, layout, material designations, methods of installation, and accessories including the following:

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

[ Sign and seal fabrication drawings by a registered professional engineer.

#### ] 1.6.2 Design Data Required

Submit **metal framing calculations** with design criteria and structural loading to verify sizes, thickness, and spacing of members and connections signed and sealed by a registered professional engineer. Show methods and practices used in installation.

### ] PART 2 PRODUCTS

#### 2.1 STEEL **STUDS, JOISTS**, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with **ASTM C955** and the following.

- a. Provide products with an average **recycled content of steel products** so postconsumer recycled content plus one half of preconsumer recycled content not less than [25] [\_\_\_\_\_] percent.

- b. Steel Sheet: **ASTM A1003/A1003M**, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
- (1) Grade: [ST33H (ST230H)] [ST50H (ST340H)] [[\_\_\_\_]] [As required by structural performance].
  - (2) Coating: [G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90)] [G90 (Z275)] [[\_\_\_\_]].
- c. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
- (1) Minimum Base-Metal Thickness: [ 0.0329 inch] [ 0.0428 inch] [ 0.0538 inch] [ 0.0677 inch] [ 0.0966 inch].
  - (2) Flange Width: [ 1-3/8 inches] [ 1-5/8 inches] [ 2 inches] [ 2-1/2 inches].
- d. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
- (1) Minimum Base-Metal Thickness: [ 0.0329 inch] [ 0.0428 inch] [ 0.0538 inch] [ 0.0677 inch] [ 0.0966 inch] [Matching steel studs].
  - (2) Flange Width: [ [1-1/4 inches] [\_\_\_\_]].
- e. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
- (1) Minimum Base-Metal Thickness: [ 0.0329 inch] [ 0.0428 inch] [ 0.0538 inch] [ 0.0677 inch] [ 0.0966 inch] [Matching steel studs].
  - (2) Flange Width: [ [1-5/8 inches] [\_\_\_\_]], minimum at top and bottom chords connecting to sheathing or directly fastened construction.
- f. Floor Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
- (1) Minimum Base-Metal Thickness: [ 0.0329 inch] [ 0.0428 inch] [ 0.0538 inch] [ 0.0677 inch] [ 0.0966 inch] [Matching steel studs].
  - (2) Flange Width: [ [1-5/8 inches] [\_\_\_\_]], minimum at top and bottom chords connecting to sheathing or directly fastened construction.

#### 2.1.1 Studs and Joists of 54 mils (0.054 Inch) and Heavier

Galvanized steel, **ASTM A653/A653M** and **ASTM A1003/A1003M**, SS Grade 50, [G60] [G90].

#### 2.1.2 Studs and Joists of 43 mils (0.043 Inch) and Lighter

Studs and Joists of 43 mils (0.043 Inch) and Lighter, Track, and Accessories (All thicknesses): Galvanized steel, **ASTM A653/A653M** and **ASTM A1003/A1003M**, SS, Grade 33 33,000 psi G60.



### 2.1.3 Sizes, Thickness, Section Modulus, and Other Structural Properties

Size and thickness [as indicated][as required].

## 2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

## 2.3 CONNECTIONS

### 2.3.1 Steel-To-Concrete Connections

- a. Anchor Rods: ASTM F1554, [Grade 36][Grade 55]; galvanized per ASTM A153/A153M.
- b. Post-Installed Concrete Anchors: Adhesive or expansion anchors fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
- c. Power-Actuated Fasteners: Fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC 70 greater than or equal to the design load as determined by testing per ASTM E1190 conducted by a qualified testing agency.

### 2.3.2 Steel-To-Steel Connections

- a. Screws: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel screws of the type and size indicated. Provide low-profile head beneath sheathing and manufacturer's standard elsewhere. Electroplated to a minimum of 5 micron zinc coating per ASTM F1941 or hot-dipped galvanized per ASTM A123/A123M or ASTM A153/A153M.
- b. Bolts: ASTM A307 coated by hot-dip process per ASTM F2329/F2329M or zinc-coated by mechanical-deposition process per ASTM B695, Class 55.
- c. Welding Electrodes: Comply with AWS standards.

## 2.4 PLASTIC GROMMETS

Supply plastic grommets for stud webs as recommended by stud manufacturer, to protect electrical wires and plumbing piping. Prevent metal-to-metal contact between wiring/piping and studs.

## 2.5 SEALER GASKET

Closed-cell neoprene foam, 1/4-inch thick, selected from manufacturer's standard widths to match width of bottom track on concrete slab or foundation.

## PART 3 EXECUTION

### 3.1 TRUSS FABRICATION

- a. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
- b. Truss must be fabricated either on site or off site prior to erection.
- c. Fabricate trusses using jigs or templates.
- d. Splices can only occur at joints.
- e. Cut truss members by sawing or shearing: do not torch cut.
- f. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
- g. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- h. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses to prevent damage or permanent distortion.

### 3.2 FASTENING

Fasten framing members together by welding or by using self-drilling, self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

#### 3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI S100. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. Submit certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 43 mils.

#### 3.2.2 Screws

Screws shall be of the self-drilling self-tapping type, size, and location [as indicated] [as required]. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI S100. Screws covered by sheathing materials shall have low profile heads.

3.2.3 Anchors

Anchors shall be of the type, size, and location [as indicated] [as required].

3.2.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location [as indicated] [as required].

3.3 INSTALLATION

Install cold-formed framing in accordance with [ASTM C1007](#) and [AISI S200](#).

Install cold-formed steel framing according to [AISI S202](#) and to manufacturer's written instructions unless more stringent requirements are indicated.

3.3.1 Tracks

Provide accurately aligned runners at top and bottom of studs. Install sealer gasket under bottom of track on concrete slab or foundation. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least [3 inches](#) from the edge of concrete slabs.

3.3.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings [2 feet](#) wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and [AISI S100](#). Bracing shall be not less than the following:

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
Wind load only	Up to <a href="#">10 feet</a>	One row at mid-height
	Over <a href="#">10 feet</a>	Rows <a href="#">5'-0"</a> o.c. maximum
Axial load	Up to <a href="#">10 feet</a>	Two rows at 1/3 points
	Over <a href="#">10 feet</a>	Rows <a href="#">3'-4"</a> o.c. maximum

3.3.3 Joists and Trusses

- a. Provide a stud directly under each joist or truss. The maximum spacing of studs as indicated shall be maintained.
- b. Install, bridge, and brace cold-formed steel trusses according to **AISI S200**, **AISI S214**, AISI's "Code of Standard Practice for Cold-Formed Steel Structural Framing," and manufacturer's written instructions unless more stringent requirements are indicated.
- c. Install temporary bracing and supports. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- d. Do not alter, cut, or remove framing members or connections of trusses.

#### 3.3.4 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
  - (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;
  - (3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

## SECTION 05 50 13

## MISCELLANEOUS METAL FABRICATIONS

05/17, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2016) Code of Standard Practice for Steel Buildings and Bridges

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.6.2 (2020) Square Head Set Screws and Slotted Headless Set Screws (Inch Series)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASME B18.21.2M (1999; R 2014) Lock Washers (Metric Series)

ASME B18.22M	(1981; R 2017) Metric Plain Washers
AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)	
ASSP A10.3	(2020) Safety Requirements for Powder-Actuated Fastening Systems American National Standard for Construction and Demolition Operations
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
ASTM INTERNATIONAL (ASTM)	
ASTM A29/A29M	(2020) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A467/A467M	(2020) Standard Specification for Machine Coil Chain
ASTM A475	(2022) Standard Specification for Metallic-Coated Steel Wire Strand

ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786/A786M	(2015; R 2021) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C1513	(2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E488/E488M	(2022) Standard Test Methods for Strength of Anchors in Concrete Elements
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM MBG 531	(2017) Metal Bar Grating Manual
NAAMM MBG 532	(2019) Heavy Duty Metal Bar Grating Manual
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Structural Steel Door Frames, Fabrication Drawings; G[, [\_\_\_\_]]

Cover Plates and Frames, Installation Drawings; G[, [\_\_\_\_]]

Expansion Joint Covers, Installation Drawings; G[, [\_\_\_\_]]

Floor Gratings, Installation Drawings; G[, [\_\_\_\_]]

Roof Walkways, Installation Drawings; G[, [\_\_\_\_]]

Bollards/Pipe Guards; G[, [\_\_\_\_]]

Wheel Guards, Installation Drawings; G[, [\_\_\_\_]]

Window[ and Door] Guards, Installation Drawings; G[, [\_\_\_\_]]

Embedded Angles and Plates, Installation Drawings; G[, [\_\_\_\_]]

Roof Hatches, Installation Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data



Corner Guards

Cover Plates and Frames; G[, [\_\_\_\_\_]]

Expansion Joint Covers; G[, [\_\_\_\_\_]]

Floor Gratings; G[, [\_\_\_\_\_]]

Roof Walkways; G[, [\_\_\_\_\_]]

Structural Steel Door Frames; G[, [\_\_\_\_\_]]

Wheel Guards

Window[ and Door] Guards; G[, [\_\_\_\_\_]]

Roof Hatches; G[, [\_\_\_\_\_]]

Each Downspout Terminations Type; G[, [\_\_\_\_\_]]

Recycled Content; S

#### SD-04 Samples

Expansion Joint Covers

#### SD-07 Certificates

- [ Certificates of Compliance; G[, [\_\_\_\_\_]]
- ] [ Certified Mill Test Reports for Chemistry and Mechanical Properties; G[, [\_\_\_\_\_]]
- ] ]

### 1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

### 1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

### 1.5 MISCELLANEOUS REQUIREMENTS

#### 1.5.1 Fabrication Drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

#### 1.5.2 Installation Drawings

Submit templates, erection, and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation in relation to the building construction.

## PART 2 PRODUCTS

## 2.1 RECYCLED CONTENT

Provide products with recycled content. [ Provide [certificates of compliance](#) for recycled content.]

## 2.2 MATERIALS

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied. [ Submit the manufacturer's [certified mill](#) reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied materials.]

## 2.2.1 Structural Carbon Steel

Provide in accordance with [ASTM A36/A36M](#).

## 2.2.2 Structural Tubing

Provide in accordance with [ASTM A500/A500M](#).

## 2.2.3 Steel Pipe

Provide in accordance with [ASTM A53/A53M](#), Type E or S, Grade B.

## 2.2.4 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with [ASTM A47/A47M](#).

## 2.2.5 Gratings

- a. Provide gray cast iron in accordance with [ASTM A48/A48M](#), Class 40.
- b. Provide metal plank grating, non-slip requirement, [aluminum in accordance with [ASTM B209M](#) [ASTM B209](#), 6061-T6] [ steel in accordance with [ASTM A653/A653M](#), Z275 G90].
- c. Provide metal bar type grating in accordance with [ [NAAMM MBG 531](#)] [ and] [ [NAAMM MBG 532](#)].

## 2.2.6 Floor Plates, Patterned

Provide floor plate in accordance with [ASTM A786/A786M](#). Provide steel plate not less than 14 gage.

## 2.2.7 Anchor Bolts

Provide in accordance with [ASTM F1554](#). Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

## 2.2.7.1 [Expansion Anchors] [Sleeve Anchors] [Adhesive Anchors]

Provide [\_\_\_\_\_]in. diameter [expansion anchors] [sleeve anchors] [adhesive anchors]. Minimum [concrete] [masonry] embedment of [\_\_\_\_\_]in. Design values listed are as tested in accordance with [ASTM E488/E488M](#).

- a. Provide minimum [ultimate][allowable] pullout value of [\_\_\_\_\_]lb.  
Calculate pullout capacity according to ACI 318.
- b. Provide minimum [ultimate][allowable] shear value of [\_\_\_\_\_]lb.  
Calculate shear capacity according to ACI 318.

#### 2.2.7.2 Lag Screws and Bolts

Provide in accordance with ASME B18.2.1, type and grade best suited for the purpose.

#### 2.2.7.3 Toggle Bolts

Provide in accordance with ASME B18.2.1.

#### 2.2.7.4 Bolts, Nuts, Studs and Rivets

Provide in accordance with ASME B18.2.2 or ASTM A307.

#### 2.2.7.5 Powder Actuated Fasteners

Follow safety provisions in accordance with ASSP A10.3.

#### 2.2.7.6 Screws

Provide in accordance with ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

#### 2.2.7.7 Washers

Provide plain washers in accordance with ASME B18.22M, ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers in accordance with ASME B18.21.2M, ASME B18.21.1.

#### 2.2.7.8 Welded Headed Shear Studs

Provide in accordance with [ ASTM A108 ] [ or ] [ ASTM A29/A29M-12 ].

#### 2.2.8 Aluminum Alloy Products

Provide in accordance with ASTM B209M, ASTM B209 for sheet plate, ASTM B221M, ASTM B221M, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

### 2.3 FABRICATION FINISHES

#### 2.3.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Provide galvanizing in accordance with ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90.

#### 2.3.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

### [2.3.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint in accordance with [ASTM A780/A780M](#) or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat, with a torch, surfaces to which stick or paste material will be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

### ]2.3.4 Shop Cleaning and Painting

#### 2.3.4.1 Surface Preparation

Blast clean surfaces in accordance with [SSPC SP 6/NACE No.3](#). Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with [SSPC SP 3](#) in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

#### 2.3.4.2 Pretreatment, Priming and Painting

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions. [On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of [1.0 mil](#). Tint additional prime coat with a small amount of tinting pigment.]

#### 2.3.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

#### 2.3.6 Aluminum Surfaces

##### 2.3.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

##### 2.3.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, [AA DAF45](#). Unless otherwise specified, provide all other aluminum items with a [ standard mill finish] [ hand sanded or machine finish to a 240 grit] [ anodized finish]. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations. Provide in accordance with [AA DAF45](#). Provide a polished satin finish on items to be anodized.

### 2.4 CORNER GUARDS

For jambs and sills of openings and edges of platforms provide steel shapes

and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with glazed or ceramic tile finish on walls with 0.0625 inch thick corrosion-resisting steel with [polished] [ or] [ satin] finish, extend 5 feet above the top of cove base or to the top of the wainscot, whichever is less, and securely anchor to the supporting wall. Provide [galvanized] [\_\_\_\_\_] corner guards on exterior. [ Provide interior corner guards as indicated in Section 10 26 00 WALL AND DOOR PROTECTION.]

## 2.5 COVER PLATES AND FRAMES

Fabricate cover plates of [1/4] [\_\_\_\_\_] inch thick rolled steel weighing not more than 100 pounds per plate with a [selected raised pattern nonslip top surface] [slip-resistant, carbon steel in accordance with ASTM A283/A283M. Provide aluminum oxide or silicon carbide on wearing surfaces]. Provide [galvanized] [shop painted] plate. Reinforce to sustain a live load of [\_\_\_\_\_] pounds per square foot. Provide structural steel shapes and plates for frames, [with bent steel bars or headed anchors welded to frame for anchoring to concrete] [securely fastened to the structure as indicated]. Miter and weld all corners. Butt joint straight runs. Allow for expansion on straight runs over 15 feet. [ Provide holes for lifting tools.] [ Provide flush drop handles for removal where indicated; form from 1/4 inch round stock.] [ Provide holes and openings with 1/2 inch clearance for pipes and equipment.] Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld all connections and grind top surface smooth. Weld bar stops every six inches. Provide 1/8 inch clearance at edges and between cover plates.

## 2.6 EXPANSION JOINT COVERS

Provide expansion joint covers constructed of extruded aluminum with anodized satin aluminum finish for walls and ceilings and standard mill finish for floor covers and exterior covers. Furnish plates, backup angles, expansion filler strips and anchors as indicated. [ Provide a [\_\_\_\_\_] -hour fire-rating for expansion joints.]

## 2.7 FLOOR GRATINGS AND ROOF WALKWAYS

Design [steel] [aluminum] grating in accordance with NAAMM MBG 531 [ and NAAMM MBG 532] for bar type gratings, or in accordance with manufacturer's charts for plank grating. [Galvanize steel floor gratings.]

- a. Design floor gratings to support a stress live load of [\_\_\_\_\_] pounds per square foot for the spans indicated, with maximum deflection of L/240.
- [ b. In accordance with NAAMM MBG 531 [, NAAMM MBG 532], band edges of grating with bars of the same size as the bearing bars. Weld banding in accordance with the manufacturer's standard for trim [unless otherwise indicated]. Design tops of bearing bars, cross or intermediate bars to be in the same plane and to match grating finish.
- ] [b. NAAMM MBG 531 [, NAAMM MBG 532], band ends of gratings with bars of the same or greater thickness than the metal used for grating. Weld banding bars to bearing bars or channels at least every fourth bar or channel and in every corner. Tack weld intervening bars or channels. Band diagonal or round cuts by welding bars of the same or greater thickness as the grating and in accordance with the manufacturer's standard for trim [unless otherwise indicated].

- ] c. [Attach gratings to structural members with welded-on anchors.] [Anchor gratings to structural members with bolts, toggle bolts, or expansion shields and bolts.] [Attach grating in accordance with manufacturer's roof attachment system.]
- ] d. Provide slip resistant surface finishes.
- [ e. Rooftop walkway: Minimum 2 feet wide, 14 gage, ASTM A653/A653M, G-90, steel with slip resistant surface. Furnish all brackets, connectors and other accessories. Support at minimum 5 foot intervals on hard rubber pads in accordance with manufacturer's instructions.

## ] 2.8 BOLLARDS/PIPE GUARDS

Provide [\_\_\_\_\_] inch [galvanized] [prime coated] [standard] [extra strong] weight steel pipe in accordance with ASTM A53/A53M. Anchor posts in concrete [as indicated] and fill solidly with concrete with minimum compressive strength of 2500 psi.

## 2.9 DOWNSPOUT TERMINATIONS

Provide [4x4 inch], [4x6 inch] [and] [or] [6x6 inch] [\_\_\_\_\_] aluminum downspout tile adapter with [mill] [manufacturer's standard powder coated] finish. Units shall have all seams welded.

Provide [nickel bronze] [polished bronze] [chrome plated] cast downspout nozzle and flange.

Provide [4x3 inch], [5x4 inch] [and] [or] [4 inch diameter] [\_\_\_\_\_] [cast iron] [galvanized cast iron] downspout boot with cleanout access and manufacturer's standard cast iron strap.

## 2.10 MISCELLANEOUS PLATES AND SHAPES

Provide items that do not form a part of the structural steel framework, such as lintels, sill angles, [support framing for ceiling-mounted toilet partitions,] miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions [as indicated and] [as required to support wall loads over openings. Provide with connections and [fasteners] [welds]. Construct to have at least [[\_\_\_\_\_] in] [8 in] bearing on masonry at each end.

Provide angles and plates in accordance with ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements in accordance with ASTM A123/A123M.

## 2.11 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, minimum 3/16 inch diameter, with a minimum of twelve links per one foot, and snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide boat type snap hooks. Provide galvanized 3/8 inch bolt with 3/4 inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 4 inches longer than the anchorage spacing, for each guarded area.

## 2.12 SECURITY GRILLES

Fabricate of channel frames with not less than two masonry anchors at each jamb and 1/2 inch hardened steel bars spaced not over 4 inches both ways and welded to frame. Provide 18 by 16 mesh screen and two layers of 1/4 inch hardware cloth clamped to frame.

#### 2.13 STEEL PLATE WAINSCOTS FOR CONCRETE OR MASONRY COLUMNS

Shop bend to radius for round columns and at right angles for square and rectangular columns with slight 1/4 inch radius on corners, with no horizontal joints and not more than 2 vertical joints single strapped and butt welded with a thickness of [\_\_\_\_\_].

#### 2.14 STRUCTURAL STEEL DOOR FRAMES

- [ a. Provide frames as indicated. Unless otherwise indicated, construct frames of structural shapes, or shape and plate composite, to form a full depth channel shape with at least 1-1/2 inch outstanding legs. For single swing doors, provide continuous 5/8 by 1-1/2 inch bar stock stops at head and jambs. For freight elevator hoistway entrance, include a non-skid metal sill. Provide extruded metal frames as required by the elevator manufacturer.
- ] b. Provide support where track, guides, hoods, hangers, operators, and other accessories are required.
- c. Provide jamb anchors near top, bottom, and at not more than 24 inch intervals. Provide the bottom of each jamb member with a clip angle welded in place with two 1/2 inch diameter floor bolts for adjustment.
- [ d. Provide spreaders between bottoms of floor jamb members. When floor construction permits, spreaders may be left in place and concealed in the floor.
- ]
  - [ Provide frames of rolled shapes as indicated. Miter and weld heads to jambs, or provide riveted clip angle connections concealed in the finished work. Provide frames for swinging doors with 5/8 by 1-1/2 inch solid bar stops secured to the frame by welding or by 1/4 inch diameter countersunk machine screws spaced not more than 12 inches on centers. Stiffen head openings greater than 3 feet as necessary to limit deflection to not more than 1/16 inch. Secure frames to masonry with zinc-coated metal anchors spaced not more than 30 inches on centers. Where necessary to engage the threads of machine screws for fastening hardware, back frames on inside faces with steel plates of suitable thickness. Tap frames and reinforcing plates as necessary for the installation of hardware and other work. Countersink rivets and screw heads where they will be exposed in the finished work. Grind welds smooth.

#### ]2.15 WHEEL GUARDS

Provide wheel guards of hollow, heavy-duty type cast iron in accordance with ASTM A48/A48M, with shaped, [rounded ] [half round ] [three quarters round ] top, at least 18 inches high, and designed to provide a minimum of 6 inches of protection.

#### [2.16 ROOF HATCHES (SCUTTLES)

Provide [aluminum] [zinc-coated steel] sheets not less than 14 gauge with 3 inch beaded flange, welded and ground at corners. Provide a minimum clear opening of 30 by 36 inches. Insulate cover and curb with one inch thick

rigid fiberboard insulation, covered and protected by [aluminum sheet][zinc-coated steel liner] of not less than 26 gage. Provide with 12 inches high curb, formed with 3 inch mounting flanges with holes for securing to the roof deck.

#### ]2.17 WINDOW[ AND DOOR] GUARDS, DIAMOND-MESH TYPE

Provide diamond-mesh window[ and door] guards constructed of woven steel wire [or expanded metal ]framed with hot-rolled or cold-formed structural steel shapes. Provide woven wire panels of 10 gage, 1-1/2 inch mesh secured through weaving bar to one by 1/2 by 1/8 inch thick channel frame.[ Provide expanded metal panels in accordance with ASTM F1267.] Miter and weld corners of frames.[ Mount window[ and door] guards on interior of window[ and door] frame with not less than two tamperproof hinged butts mounted on wood jambs with 1/4 inch lag bolts, to masonry jamb with toggle bolts, or welded to metal jambs.][ Mount window[ and door] guards on exterior of window frame with not less than two tamperproof hinged butts mounted on one by 1/2 by 1/8 inch jamb channel attached as indicated to 2 by 1/4 inch plate anchored to wood jamb with 1/4 inch lag bolts; to masonry jamb with toggle bolts, or to concrete jambs and solid masonry jambs with expansion shields and bolts.] Provide one additional butt for each 3 foot internal length of guard over 5 feet. Provide one tamperproof hasp and padlock, with access from the interior, for each butt used and installed on the jamb opposite to that hinged.[ Provide galvanized guards and accessories.]

#### 2.18 WINDOW[ AND DOOR] GUARDS

Provide woven wire window[ and door] guards of size as necessary to completely fill opening. Construct guards with 3/8 inch round rod frame and 1-1/2 inch diamond-mesh of No. 10 U.S. Gage 0.135 diameter wire. Provide all materials with zinc coating. Provide a minimum of three hinge side clips on one side and two lock ring hasps on the opposite side.

#### 2.19 CHIMNEYS, VENTS, AND SMOKESTACKS

Provide chimneys and vents in accordance with NFPA 211. Form chimney connectors of minimum 20 gauge galvanized steel. Design and construct stacks to withstand a wind velocity of [\_\_\_\_\_] mph in accordance with ASCE 7-16. Construct unlined stacks of black-steel plates not less than 3/16 inch thick in accordance with ASTM A36/A36M. Weld seams and joints. Provide angle flanges for connections to boilers, other equipment, and stack supports.

#### 2.20 CLEANOUT DOORS

Provide [galvanized ][cast iron ]cleanout doors with frames, sized to match flues unless otherwise indicated. Provide continuous flange and anchors for securing frames to masonry. Provide smokeproof, hinged doors with[ lockable] fastening devices to hold doors closed[ and secured].

#### 2.21 COAL HOPPER DOORS

Provide coal hopper doors of [galvanized][\_\_\_\_\_] steel plates and shapes. Provide complete assemblies including frames, stops, wall boxes, hinges, and hasp or lock-type latches. Weld joints and attachments.

#### 2.22 GUY CABLES



Provide guy cables as pre-stretched, galvanized wire rope of sizes indicated. Provide wire rope in accordance with [ASTM A475](#), high strength grade with Class A coating. Guys must have a factory attached clevis top-end fitting, a factory attached open-bridge strand socket bottom-end fitting, and must be complete with oval eye, threaded anchor rods. Provide hot-dip galvanized fittings and accessories.

### 2.23 WINDOW SUB-SILL

Provide window sub-sill of extruded aluminum alloy, standard mill finish, of size(s) and design(s) indicated. Provide a minimum of two anchors per window section for securing to mortar joints of masonry sill course. Provide sills with protective coating for shipment, of two coats of a clear, colorless, methacrylate lacquer applied to all surfaces of the sills.

### 2.24 WINDOW WELLS

Provide window wells in a minimum [16 gauge](#), corrugated sheet steel, hot-dip galvanized after fabrication, with top edge of window well walls with a [3/4 inch](#) bead or rolled top. Provide windows wells with radiused corners and of sizes that overlap each window by a minimum of [3 inches](#) on each side. Provide removable covers, hot-dipped galvanized after fabrication, consisting of steel bar grate, with bars spaced at not more than [2 inch](#) centers and welded to [one by 1/4 inch](#) frame. Frames must fit into, and rest on top edge of, window wells.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated in accordance with manufacturer's instructions. Verify all field dimensions prior to fabrication. Include materials and parts necessary to complete each assembly, whether indicated or not. Miss-alignment and miss-sizing of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Joints exposed to weather must be watertight.

### 3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersunk rivets where exposed. Provide coped and mitered corner joints aligned flush and without gaps.

### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage as necessary, whether indicated or not, for fastening miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts (when approved for concrete), through bolts for masonry, headed shear studs, machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals), that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable.

Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise. [ Test a minimum of 2 bolt, nut, and washer assemblies from each certified mill batch in a tension measuring device at the job site prior to the beginning of bolting start-up.]

### 3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in metal work in ample time for securing in place as the work progresses.

### 3.5 WELDING

Perform welding, welding inspection, and corrective welding in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation. Provide welded headed shear studs in accordance with AWS D1.1/D1.1M, Clause 7, except as otherwise specified. Provide in accordance with the safety requirements of EM 385-1-1.

### 3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect in accordance with ASTM D1187/D1187M, asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

### 3.7 PREPARATION

#### 3.7.1 Material Coatings and Surfaces

Remove rust preventive coating just prior to field erection, using a remover approved by the metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

#### 3.7.2 Environmental Conditions

Do not clean or paint surfaces when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer. Metal surfaces to be painted must be dry for a minimum of 48 hours prior to the application of primer or paint.

### 3.8 EXPANSION JOINT COVERS

Provide in accordance with manufacturer's written instructions [ and with seismic requirements indicated]. Verify installation allows specified movement prior to completion of work

### 3.9 COVER PLATES AND FRAMES

Provide tops of cover plates and frames flush with finished surface. Test for trip hazards and adjust for any encountered lippage.

### 3.10 WHEEL GUARDS

Anchor guards to concrete or masonry in accordance with manufacturer's instructions. Fill hollow cores solid with concrete with minimum compressive strength of 2500 psi.

### [3.11 ROOF HATCH (SCUTTLES)

Construction and accessories as follows:

- a. Provide insulated cover and curb with mounting flanges for securing to roof deck. Provide curbs with integral metal cap flashing of the same gage and metal as the curb, fully welded and ground at corners for weather tightness.
- b. Provide hatches completely assembled, with pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latches with turn handles on inside and outside, and neoprene draft seals. Provide fasteners for padlocking from the inside. Provide covers with automatic hold-open arms complete with grip handle to permit one hand release. Cover action must be smooth through its entire range of motion with an operating pressure of approximately 30 pounds.

### ]3.12 INSTALLATION OF CHIMNEYS, VENTS, AND SMOKESTACKS

Install chimneys and vents in accordance with NFPA 211. Provide cleanout openings with a tight-fitting, hinged, cast-iron door and frame at the base of each smokestack. Provide a top band on stacks for attachment of painter's rigging in accordance with structural requirements. Provide roof housing, rain cap, downdraft diverter, fire damper, and other accessories required for a complete installation. Join sections of prefabricated lined stacks with acid-resisting high temperature cement and steel draw bands. Flash as necessary to prevent accumulation of water in the smokestack.

### 3.13 DOOR GUARD FRAME

Mount door guard frames over glazed openings using 1/4 inch lag bolts on the interiors of wood doors or tamperproof through bolts on the interiors of metal doors.

### 3.14 INSTALLATION OF BOLLARDS/PIPE GUARDS

Set bollards/pipe guards vertically in concrete piers. Fill hollow cores with concrete having a compressive strength of 3000 psi.

### 3.15 INSTALLATION OF DOWNSPOUT TERMINATIONS

Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

### 3.16 MOUNTING OF SAFETY CHAINS

Provide safety chains where indicated. Mount the top chain 3 feet 6 inches [\_\_\_\_\_] above the [floor][ground] and mount the lower chain 2 feet [\_\_\_\_\_] above the [floor][ground].

### 3.17 STRUCTURAL STEEL DOOR FRAMES

Secure door frames to the floor slab by means of angle clips and expansion bolts. Provide any necessary reinforcements and drill and tap frames as required for hardware. Clean metal shavings from finished surfaces at the

end of each work day.

For freight elevator hoistway entrances, include a non-skid metal sill installed in accordance with the elevator manufacturer's written installation instructions.

### 3.18 INSTALLATION OF WHEEL GUARDS

Fill wheel guards with concrete and anchor to slab in accordance with manufacturer's recommendations.

### 3.19 BAR-GRILLE WINDOW GUARDS

Securely anchor bar-grille window guards to masonry with 1/2 inch diameter prison-type screws or bolts and expansion shields, or other type of fastenings if the ends of such fastenings are welded to the adjoining metal grilles or otherwise made tamperproof in manner as approved by the Contracting Officer. Spanner-head screws or bolts are not considered prison-type fasteners.

### 3.20 DIAMOND MESH WINDOW [AND DOOR ] GUARDS

Provide diamond mesh window guards on [interior window frames with not less than two tamperproof hinged butts mounted on wood jambs.] [exterior of window frames with not less than two tamperproof hinged butts mounted on one by 12 by 1/8 inch jamb channel attached to 2 by 1/4 inch plate anchored] [ to wood jambs with 1/4 inch lag bolt,] to masonry jamb with toggle bolts[, or to concrete jambs and solid masonry jambs with expansion shields and bolts]. Provide one additional butt for each 3 foot internal length of guard over 5 feet. Install hasp and padlock jamb opposite the hinged side.

### 3.21 INSTALLATION OF WINDOW WELLS

Provide window wells with walls securely anchored to foundation surface. Excavate the area within the well to the bottom of the well and cover with a 4 inch thick layer of coarse gravel or crushed rock.

### 3.22 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions[ as indicated and] as required to support wall loads over openings. Provide with connections and [fasteners] [welds]. Construct to have at least 8 inches bearing on masonry at each end.

-- End of Section --

## SECTION 05 50 14

## STRUCTURAL METAL FABRICATIONS

08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA ADM (2020) Aluminum Design Manual

## AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA ISO 22849-A12 (2012) Design Recommendations for Bevel Gears

AGMA ISO 23509-A08 (2008) Bevel and Hypoid Gear Geometry

ANSI/AGMA 6001 (2008E; R 2014) Design and Selection of Components for Enclosed Gear Drives

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B4.1 (1967; R 1994; R 2004; R 2009; R 2020) Preferred Limits and Fits for Cylindrical Parts

ASME B46.1 (2020) Surface Texture, Surface Roughness, Waviness and Lay

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A380/A380M	(2017) Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B177/B177M	(2011; R 2021) Standard Guide for Engineering Chromium Electroplating
ASTM B766	(1986; R 2015) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM D962	(1981; R 2014) Aluminum Powder and Paste Pigments for Paints
ASTM E94/E94M	(2017) Standard Guide for Radiographic Examination Using Industrial Radiographic Film
ASTM E165/E165M	(2018) Standard Practice for Liquid Penetrant Examination for General Industry
ASTM E446	(2020) Standard Reference Radiographs for Steel Castings Up to 2 In. (51mm) in Thickness
ASTM E709	(2021) Standard Guide for Magnetic Particle Testing
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

## RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC A348	(2020) RCSC Specification for Structural Joints Using High-strength Bolts
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_]]

Welding Procedures; G[, [\_\_\_\_]]

Welding Repair Plan

Castings

SD-03 Product Data

Filler Metal

Lubricant

SD-06 Test Reports

Tests, Inspections, and Verifications

SD-07 Certificates

Welding Qualifications

Application Qualification for Steel Studs; G[, [\_\_\_\_]]

Welding of Aluminum

Weld Inspection Log

Certified Welding Inspector

Nondestructive Testing Personnel

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Detail Drawings

Submit detail drawings for metalwork and machine work, prior to fabrication, include within the detail drawings catalog cuts, templates, fabrication and assembly details and type, grade and class of material as appropriate. Indicate methods of protecting the work during shipping, storage, field assembly, and installation.

#### 1.3.2 Welding Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. [If the qualification date of the welder or welding operator is more than 6 months old, accompany the welding operator's qualification certificate with a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.]

Conform to all requirements specified in [AWS D1.1/D1.1M] and [AA ADM] [or AWS D1.2/D1.2M].

## PART 2 PRODUCTS

### 2.1 FABRICATION

#### 2.1.1 Structural Fabrication

Material must be straight before being laid off or worked. Perform straightening, if necessary, by methods that will not impair the metal. Sharp kinks or bends are cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Make bends using approved dies, press brakes or bending rolls. Where heating is required, take precautions to avoid overheating the metal and allow it to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material, other than structural steel, is subject to approval and must be indicated on detail drawings. Shearing must be accurate and all portions of the work neatly finished. Make corners square and true unless otherwise shown. Fillet re-entrant cuts to a minimum radius of  $3/4$  inch unless otherwise approved. Provide finished members free of twists, bends and open joints. Tighten bolts, nuts and screws.

#### 2.1.1.1 Dimensional Tolerances for Structural Work

Measure dimensions using an approved calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit must be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown, an allowable variation of  $1/32$  inch is permissible in the overall length of component members with both ends milled; component members without milled ends must not deviate from the dimensions shown by more than  $1/16$  inch for members 30 feet or less in length, and by more than  $1/8$  inch for members over 30 feet in length.

#### 2.1.1.2 Structural Steel Fabrication

Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Prepare surfaces and edges in accordance with AWS D1.1/D1.1M, Prequalification of WPSs Clause. Where structural steel is not to be welded, chipping or grinding will not be required except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Chip, grind or machine to sound metal hand-guided cuts which are to be exposed or visible.

#### 2.1.1.3 Structural Aluminum Fabrication

Lay out and cut aluminum in accordance with the AA ADM, Section 6.

### 2.1.2 Welding

#### 2.1.2.1 Welding of Structural Steel

##### 2.1.2.1.1 Welding Procedures for Structural Steel

Use prequalified welding procedures for structural steel as described in AWS D1.1/D1.1M, Prequalification of WPSs Clause or qualify by tests as prescribed in AWS D1.1/D1.1M, Qualification Clause. For welding procedures qualified by tests, the coupon welding and specimen testing will be witnessed and the test report document signed by the Contracting Officer. Approval of any welding procedure does not relieve the Contractor of the responsibility for producing a finished structure meeting all requirements of these specifications. The Contractor will be directed or authorized to make any changes in previously approved welding procedures that are deemed



necessary or desirable by the Contracting Officer.

- a. Submit a complete schedule of welding procedures for each steel structure to be welded prior to commencing fabrication. Provide the schedule in conformance with the requirements specified in the provisions of [AWS D1.1/D1.1M](#)
- b. Provide within the schedule detailed procedure specifications and tables or diagrams showing the procedures to be used for each required joint. Include in the welding procedures filler metal, preheat, interpass temperature and stress-relief heat treatment requirements. Clearly identify each welding procedure as being prequalified or required to be qualified by tests.
- c. Show types and locations of welds designated or in the specifications to receive nondestructive testing in the welding procedures.

#### 2.1.2.1.2 Welding Process

Perform welding of structural steel by an electric arc welding process using a method which excludes the atmosphere from the molten metal and conforms to the applicable provisions of [AWS D1.1/D1.1M](#). Minimize residual stresses, distortion and shrinkage from welding.

#### 2.1.2.1.3 Welding Technique

##### 2.1.2.1.3.1 Filler Metal

Provide the electrode, electrode-flux combination and grade of filler metal conforming to the appropriate AWS specification for the base metal and welding process being used or be as shown where a specific choice of AWS specification allowables is required. Submit filler metal product data. Include the AWS designation of the electrodes to be used in the schedule of welding procedures. Use only low hydrogen electrodes for manual shielded metal-arc welding regardless of the thickness of the steel. Use a controlled temperature storage oven at the job site as prescribed by [AWS D1.1/D1.1M](#), Fabrication Clause to maintain low moisture of low hydrogen electrodes.

##### 2.1.2.1.3.2 Preheat and Interpass Temperature

Perform preheating as required by [AWS D1.1/D1.1M](#), Fabrication Clause or as otherwise specified except that the temperature of the base metal must be at least 70 degrees F. Slowly and uniformly preheat the joint area by approved means to the prescribed temperature, held at that temperature until the welding is completed and then permitted to cool slowly in still air.

##### 2.1.2.1.3.3 Stress-Relief Heat Treatment

Where stress relief heat treatment is specified or shown, perform in accordance with the requirements of [AWS D1.1/D1.1M](#), Fabrication Clause unless otherwise authorized or directed.

##### 2.1.2.1.4 Workmanship

Perform welding workmanship in accordance with [AWS D1.1/D1.1M](#), Fabrication Clause and other applicable requirements of these specifications.

#### 2.1.2.1.4.1 Preparation of Base Metal

Prior to welding inspect surfaces to be welded to ensure compliance with [AWS D1.1/D1.1M](#), Fabrication Clause.

#### 2.1.2.1.4.2 Temporary Welds

Make temporary welds, required for fabrication and erection, under the controlled conditions prescribed for permanent work. Make temporary welds using low-hydrogen welding electrodes and by welders qualified for permanent work as specified in these specifications. Conduct preheating for temporary welds as required by [AWS D1.1/D1.1M](#) for permanent welds except that the minimum temperature must be 120 degrees F in any case. In making temporary welds, do not strike arcs in other than weld locations. Remove each temporary weld and grind flush with adjacent surfaces after serving its purpose.

#### 2.1.2.1.4.3 Tack Welds

Tack welds that are to be incorporated into the permanent work are to exhibit the same quality requirements as the permanent welds; clean and thoroughly fuse them with permanent welds. Perform preheating as specified above for temporary welds. Provide cascaded ends on multiple-pass tack welds. Remove defective tack welds before permanent welding.

#### 2.1.2.2 Welding of Steel Castings

Remove unsound material from the surfaces of steel castings, to be incorporated into welded connections, by chipping, machining, air-arc gouging or grinding. Do not weld major connections designed for transfer of stresses if the temperature of the casting is lower than 100 degrees F. Preheat castings containing over 0.35 percent carbon or over 0.75 percent manganese to a temperature not to exceed 450 degrees F and conduct welding while the castings are maintained at a temperature above 350 degrees F. Welding is not permitted on castings containing carbon in excess of 0.45 percent except on written authorization. Castings requiring welding repairs after the first annealing and castings involving welding fabrication must be stress-relieved annealed prior to receiving final machining unless otherwise permitted.

#### 2.1.2.3 Welding of Steel Studs

Welding of steel studs must conform to the requirements of [AWS D1.1/D1.1M](#), Stud Welding Clause, except as otherwise specified for the procedures for welding steel studs to structural steel, including mechanical, workmanship, technique, stud application qualification, production quality control and fabrication and verification inspection procedures.

##### 2.1.2.3.1 Application Qualification for Steel Studs

As a condition of approval of the stud application process, submit certified test reports and certification that the studs conform to the requirements of [AWS D1.1/D1.1M](#), Stud Welding Clause, certified results of the stud manufacturer's stud base qualification test, and certified results of the stud application qualification test as required by [AWS D1.1/D1.1M](#), Stud Welding Clause, prior to commencing fabrication, except as otherwise specified.

##### 2.1.2.3.2 Production Control

Production control of stud welding must conform to the requirements of [AWS D1.1/D1.1M](#), Stud Welding Clause, except as otherwise specified for quality control for production welding of studs. Weld studs on which pre-production testing is to be performed must be in the same general position as required on production studs (flat, vertical, overhead or sloping). If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

#### 2.1.2.4 Welding of Aluminum

Welding of aluminum must conform to the requirements of [\[AA ADM\]](#) [and] [[AWS D1.2/D1.2M](#)]. Submit a certified report giving the results of the qualifying tests, and a complete schedule of the welding process for each aluminum fabrication to be welded prior to commencing fabrication.

#### 2.1.3 Bolted Connections

##### 2.1.3.1 Bolted Structural Steel Connections

Provide bolts, nuts and washers of the type specified or indicated. Equip all nuts with washers except for high strength bolts. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where the use of high strength bolts is specified or indicated, conform the materials, workmanship and installation to the applicable provisions of [ASTM F3125/F3125M](#). Install High Strength Bolts [ASTM F3125/F3125M](#) Grade A325 or Grade A490 in accordance with the requirements of [RCSC A348](#). All High Strength Bolted Connections are fully pretensioned to the minimum pretension as specified in [RCSC A348](#). Follow the pre-installation verification procedures outlined in [RCSC A348](#). All other bolted connections are snug tight in accordance with [RCSC A348](#).

- a. Accurately locate bolt holes, smooth, perpendicular to the member and cylindrical.
- b. Drill or subdrill holes for regular bolts and ream in the shop and not more than [1/16 inch](#) larger than the diameter of the bolt.
- c. Match-ream or drill holes for fitted bolts in the shop. Remove burrs resulting from reaming. Keep bolt threads entirely outside of the holes. The body diameter of bolts must have tolerances as recommended by [ASME B4.1](#) for the class of fit specified. Place fitted bolts in reamed holes by selective assembly to provide an LN-2 fit.
- d. Holes for high strength bolts must not have diameters more than [1/16 inch](#) larger than bolt diameters. If the thickness of the material is not greater than the diameter of the bolts, the holes may be punched. If the thickness of the material is greater than the diameter of the bolts the holes may be drilled full size or subpunched or subdrilled at least [1/8 inch](#) smaller than the diameter of the bolts and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting occurring during assembly cannot distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

##### 2.1.3.2 Bolted Aluminum Connections

Conform to the requirements of [AA ADM](#), Section J.3 and M.10 for bolted

aluminum connections.

2.1.4 Riveted Aluminum Connections

Conform to the requirements of AA ADM, Section J.4 and M.11 for riveted aluminum connections.

2.1.5 Patterns

Take care to avoid sharp corners or abrupt changes in cross section; ample fillets are to be used in the construction of patterns. Add, as required, draft and increases in pattern thicknesses to conform to the standard foundry practice applied and as necessary to ensure that all metal thicknesses of the finished castings conform to the dimensions shown and are within the tolerances specified in paragraph INSPECTION OF STEEL CASTINGS. [All patterns [, except those loaned to the Contractor by the Government,] remain the property of the Contractor.] [Patterns for those parts listed below are furnished by the Contractor, become the property of the Government and cannot be used for work under any other contract unless specifically authorized. All other patterns [, except those loaned to the Contractor by the Government,] remain the property of the Contractor.]

[2.1.5.1 Fabrication of Patterns and Core Boxes

Substantially make patterns and core boxes that become the property of the Government from thoroughly seasoned Grade B or better sugar pine, northern white pine or an approved equal. Securely glue and screw together built-up patterns and core boxes. Use approved high grade, water resistant glue that is suitably treated for resistance to fungus and insect infestation. Only light sections are permitted to be nailed. Counterbore and neatly fill screw holes with wood plugs. Dovetail or fasten with pull-out dowels loose pieces. Split patterns and core boxes must have metal dowels at partings. Skelton or sweep patterns will not be accepted unless specifically authorized. Fill all nail and tool marks on molding surfaces with beeswax and sand all surfaces with No. 0 grade sandpaper. Finish patterns with not less than three coats of an approved phenolic-resin sealer colored in accordance with the standard trade practices for pattern colors. Stamp each pattern, core box and loose piece with the part mark shown. Provide patterns complete with necessary core boxes and templates.

] [2.1.5.2 Available Patterns

The patterns listed below are available for loan to the Contractor. They are stored at [\_\_\_\_\_] and may be secured f.o.b. their place of storage upon request.

PART NO.	PATTERN NO.	CONDITION
[_____]	[_____]	[_____]
[_____]	[_____]	[_____]
[_____]	[_____]	[_____]

The Contractor assumes responsibility for the accuracy and adaptability of all parts made with the above listed patterns, as if the parts had been made from new patterns produced under this contract, and bears the expense of correcting any inaccuracies found in them.

## ]2.1.5.3 Disposition of Patterns, Core Boxes, and Templates

Substantially make and put together with screws the boxes and crates for the packing and shipment of patterns, core boxes and templates so that they can be used several times. Plainly mark each box and crate to indicate its contents. Thoroughly clean all patterns, core boxes and templates [including those loaned to the Contractor by the Government] used, crate and deliver in first-class condition with a list of same in duplicate to [\_\_\_\_\_] before final payment is made. The Contracting Officer reserves the right to withhold payment for final parts made from any pattern until such pattern is delivered. Varnish patterns and core boxes and give all templates a coat of an approved paint before being crated. Replace any pattern, core box or template lost in shipment or damaged.

## ]2.1.6 Castings

Each casting and castings weighing more than 500 required pounds must bear cast or stamped heat numbers. Submit detail drawings for each casting. Deviations from the dimensions of castings shown must not exceed amounts that impair the strength of castings by more than 10 percent as computed from the dimensions shown. Dimensions of castings shown on approved detail drawings are finished dimensions. Castings that are warped or otherwise distorted or that are oversize to an extent that interfere with proper fit with other parts of the machinery or structure will be rejected. The structure of metal in castings must be homogeneous and free from excessive nonmetallic inclusions. Excessive segregation of impurities or alloys at critical points in castings will be cause for rejection. Do not make repairs to castings prior to approval. Minor surface imperfections not affecting the strength of casting may be welded in the "green" if approved. Surface imperfections will be considered minor when the depth of the cavity prepared for welding is the lesser of 20 percent of the actual wall thickness or 1 inch. Defects other than minor surface imperfections may be welded only when specifically authorized in accordance with the following requirements:

- a. The defects have been entirely removed and are judged not to affect the strength, use or machineability of the castings when properly welded and stress relieved.
- b. The proposed welding procedure, stress relief and method of examination of the repair work have been submitted and approved.

## 2.1.7 Machine Work

Tolerances, allowances and gauges for metal fits between plain, non-threaded, cylindrical parts conform to ASME B4.1 for the class of fit shown or required unless otherwise shown on approved detail drawings. Where fits are not shown they will be suitable as approved. Tolerances for machine-finished surfaces designated by non-decimal dimensions must be within 1/64 inch. Sufficient machining stock will be allowed on placing pads to ensure true surfaces of solid material. Provide finished contact or bearing surfaces true and exact to secure full contact. Polish journal surfaces and finish all surfaces with sufficient smoothness and accuracy to ensure proper operation when assembled. Accurately machine parts entering any machine and all like parts be interchangeable except that parts assembled together for drilling or reaming of holes or machining will not be required to be interchangeable with like parts. Accurately locate all drilled bolt holes.

#### 2.1.7.1 Finished Surfaces

Provide surface finishes, indicated or specified, in accordance with [ASME B46.1](#). Values of required roughness heights are arithmetical average deviations expressed in [microinches](#). These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements is determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of [ASME B46.1](#). Values of roughness width and waviness height must be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified use that which is most suitable for the particular surface, provide the class of fit required and be indicated on the detail drawings by a symbol which conforms to [ASME B46.1](#) when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks or checks which make the part unsuitable for the intended use will be cause for rejection.

#### 2.1.7.2 Unfinished Surfaces

Lay out all work to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces chip and grind smooth or machine to secure proper alignment. Unfinished surfaces must be true to the lines and dimensions shown and be chipped or ground free of all projections and rough spots. Fill in depressions or holes not affecting the strength or usefulness of the parts in an approved manner.

#### 2.1.7.3 Pin Holes

Pin holes are to be bored true to gauges, smooth, straight and at right angles to the axis of the member. Do the boring after the member is securely fastened in position.

#### 2.1.7.4 Gears

Provide gears that have machine cut teeth of a form conforming to applicable design requirements of [AGMA ISO 22849-A12](#), [AGMA ISO 23509-A08](#) and [ANSI/AGMA 6001](#) unless otherwise specified or shown.

#### 2.1.7.5 Shafting

Turn or grind shafting with hot-rolled or cold-rolled steel, as required, unless otherwise specified or authorized. Provide fillets where changes in section occur. Cold-finished shafting may be used where keyseating is the only machine work required.

#### 2.1.7.6 Bearings

Bearings may be lined with babbitt or bronze unless otherwise specified or shown. Where the bearing pressure is in excess of 200 psi, line bearings with bronze. Pressures on lined bearings must not exceed [\_\_\_\_\_] psi of projected area unless otherwise required or authorized. Anti-friction bearings of approved types and of sizes not less than those recommended by the bearing manufacturer for the duty intended will be permitted subject to approval. Properly align all bearings provided with a suitable means of lubrication. Install anti-friction bearings as required to provide for retention of the lubricant and to exclude dirt and grit.

### 2.1.8 Miscellaneous Provisions

#### 2.1.8.1 Metallic Coatings

- a. Zinc Coatings - Apply zinc coatings in a manner and of a thickness and quality conforming to [ASTM A123/A123M](#). Where zinc coatings are destroyed by cutting, welding or other causes regalanize the affected areas. Regalanize coatings **2 ounces** or heavier with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Repair coatings less than **2 ounces** in accordance with [ASTM A780/A780M](#).
- b. Cadmium Coatings - Provide cadmium coatings of a quality and thickness conforming to the requirements of [ASTM B766](#) and inspections conforming to the requirements of [ASTM E165/E165M](#), Type [\_\_\_\_\_].
- c. Chromium Coatings - Apply chromium coatings for engineering in conformance with [ASTM B177/B177M](#).

#### 2.1.8.2 Cleaning of Corrosion-Resisting Steel

Remove oil, paint and other foreign substances from corrosion-resisting steel surfaces after fabrication. Perform cleaning by vapor degreasing or by the use of cleaners of the alkaline, emulsion or solvent type. After the surfaces have been cleaned give a final rinsing with clean water followed by a 24 hour period during which the surfaces are intermittently wet with clean water and then allowed to dry for the purpose of inspecting the clean surfaces. Visually inspect the surfaces for evidence of paint, oil, grease, welding slag, heat treatment scale, iron rust or other forms of contamination. If evidence of foreign substance is found, clean again in accordance with the applicable provisions of [ASTM A380/A380M](#). Furnish the proposed method of treatment for approval. Visually reinspect after treatment. Use only stainless steel or nonmetallic bristle brushes to remove foreign substances. Remove any contamination occurring subsequent to the initial cleaning by one or more of the methods indicated above.

#### 2.1.8.3 Lubrication

Provide the arrangement and details for lubrication as indicated. Thoroughly clean and lubricate, with an appropriate [lubricant](#), all bearing surfaces before erection or assembly. Prior to use of the lubricant submit for approval product data supporting its use in the assembly that includes the following lubricating properties as they apply, temperature range, protection against corrosion, ability to remain in bearing, ability to seal out contaminants, cooling and friction.

#### 2.1.9 Shop Assembly

Assemble [only those machinery and structural units listed below] [each machinery and structural unit furnished] in the shop to determine the correctness of the fabrication and matching of the component parts unless otherwise specified. Do not exceed those tolerances shown. Closely check each unit assembled to ensure that all necessary clearances have been provided and that binding does not occur in any moving part. Assembly in the shop must be in the same position as final installation in the field unless otherwise specified. Perform assembly and disassembly work in the presence of the Contracting Officer unless waived in writing. Immediately remedy errors or defects disclosed by the Contractor without cost to the

Government. Before disassembly for shipment match-mark each piece of a machinery or structural unit to facilitate erection in the field. Indicate the location of match-marks by circling with a ring of white paint after the shop coat of paint has been applied or as otherwise directed.

## 2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests and analyses certified by an approved laboratory to demonstrate that materials are in conformity with the specifications. These tests and analyses must be performed and certified at the Contractor's expense. Perform tests, inspections, and verifications conforming to the requirements of the particular sections of these specifications for the respective items of work unless otherwise specified or authorized. Conduct tests in the presence of the Contracting Officer if so required. Furnish specimens and samples for additional independent tests and analyses upon request by the Contracting Officer. Properly label specimens and samples and prepare for shipment. Submit certified test reports for materials with all materials delivered to the site.

### 2.2.1 Nondestructive Testing

When doubt exists as to the soundness of any material part, such part may be subjected to any form of nondestructive testing determined by the Contracting Officer. This may include ultrasonic, magnaflux, dye penetrant, x-ray, gamma ray or any other test that will thoroughly investigate the part in question. The cost of such investigation will be borne by the Government if the part is found to be sound and by the Contractor if the part is found to be defective. Any defects will be cause for rejection; replace and retest rejected parts at the Contractor's expense.

### 2.2.2 Tests of Machinery and Structural Units

The details for tests of machinery and structural units must conform to the requirements of the particular sections of these specifications covering these items. Assemble each complete machinery and structural unit and test them in the shop, in the presence of the Contracting Officer, unless otherwise directed. Waiving of tests does not relieve the Contractor of responsibility for any fault in operation, workmanship or material that occurs before the completion of the contract or guarantee. After being installed at the site, operate each complete machinery or structural unit through a sufficient number of complete cycles to demonstrate to the satisfaction of the Contracting Officer that it meets the specified operational requirements in all respects.

### 2.2.3 Inspection of Structural Steel Welding

Nondestructive testing of designated welds will be required. Supplemental examination of any joint or coupon cut from any location in any joint may also be required.

#### 2.2.3.1 Visual Examination

All visual inspection will be conducted in accordance with [AWS D1.1/D1.1M](#), by a [Certified Welding Inspector](#). Document this inspection in the [Visual Weld Inspection Log](#). Submit certificates indicating that certified welding inspectors meet the requirements of [AWS QC1](#).

#### 2.2.3.2 Nondestructive Testing



Perform as designated or described in the sections of these specifications, the nondestructive testing of shop and field welds covering the particular items of work. Record final nondestructive testing results in the Weld Inspection Log which identifies final NDT inspection of all welds requiring inspection and submit the log.

#### 2.2.3.2.1 Testing Agency

The nondestructive testing of welds and the evaluation of tests as to the acceptability of the welds must be performed by a testing agency adequately equipped and competent to perform such services or by the Contractor using suitable equipment and qualified personnel. All personnel performing nondestructive testing must be certified Level I or II in the method of NDT being utilized in accordance with ANSI/ASNT CP-189. Level I inspectors must have direct supervision of a Level II inspector. Submit certification for nondestructive testing personnel prior to all testing. In either case, written approval of the examination procedures is required and performance of the examination tests must be done in the presence of the Contracting Officer. The evaluation of tests are subject to the approval and all records become the property of the Government.

#### 2.2.3.2.2 Examination Procedures

Conform to the following requirements.

##### 2.2.3.2.2.1 Ultrasonic Testing

Examine, evaluate and report ultrasonic testing of welds in conformance to the requirements of AWS D1.1/D1.1M, Inspection Clause, for [statically] [cyclically] loaded connections. Provide ultrasonic equipment capable of making a permanent record of the test indications. Make a record of each weld tested.

##### 2.2.3.2.2.2 Magnetic Particle Inspection

Conform magnetic particle inspection of welds to the applicable provisions of ASTM E709.

##### 2.2.3.2.2.3 Dye Penetrant Inspection

Perform dye penetrant inspection of welds conforming to the applicable provisions of ASTM E165/E165M.

#### 2.2.3.2.3 Welds to be Subject to Nondestructive Testing

Test [50%] [\_\_\_\_\_] of CJP welds using ultrasonic testing per Table [6.2] [or 6.3] of AWS D1.1/D1.1M. Randomly test [50%] [\_\_\_\_\_] of all PJP and fillet welds or as indicated by magnetic particle or dye penetrant testing.

#### 2.2.3.3 Test Coupons

The Government reserves the right to require the Contractor to remove coupons from completed work when doubt as to soundness cannot be resolved by nondestructive testing. When coupons are removed from any part of a structure, repair the members cut in a neat manner with joints of the proper type to develop the full strength of the members. Peen repaired joints as approved or directed to relieve residual stress. The expense for removing and testing coupons, repairing cut members and the nondestructive

testing of repairs is borne by the Government or the Contractor in accordance with the Contract Clauses INSPECTION AND ACCEPTANCE.

2.2.3.4 Supplemental Examination

When the soundness of any weld is suspected of being deficient due to faulty welding or stresses that might occur during shipment or erection, the Government reserves the right to perform nondestructive supplemental examinations before final acceptance. The cost of such inspection will be borne by the Government.

2.2.4 Welding Repair Plan

Repair defective welds in accordance with AWS D1.1/D1.1M, Fabrication Clause. Remove defective weld metal to sound metal by use of air carbon-arc or oxygen gouging. Thoroughly clean surfaces before welding. Retest welds that have been repaired by the same methods used in the original inspection. Except for the repair of members cut to remove test coupons and found to have acceptable welds costs of repairs and retesting will be borne by the Contractor. Submit welding repair plans for steel, prior to making repairs.

2.2.5 Inspection and Testing of Steel Stud Welding

Perform fabrication and verification inspection and testing of steel stud welding conforming to the requirements of AWS D1.1/D1.1M, Welding Clause except as otherwise specified. The Contracting Officer will serve as the verification inspector. Bend or torque test one stud in every 100, including studs that do not show a full 360 degree weld flash, have been repaired by welding or whose reduction in length due to welding is less than normal as required by AWS D1.1/D1.1M, Stud Welding Clause. If any of these studs fail, bend or torque test two additional studs. If either of the two additional studs fails, all of the studs represented by the tests will be rejected. Studs that crack under testing in the weld, base metal or shank will be rejected and replaced by the Contractor at no additional cost.

2.2.6 Inspection of Steel Castings

Perform radiographic inspection of steel castings at the casting plant as designated and as described in the section of these specifications covering the particular item of work. The procedure for making, evaluating and reporting the radiographic inspection must conform to the requirements of ASTM E94/E94M. The castings will be unacceptable if shown to have defects of greater severity than the applicable reference standard specified in the following table:

DISCONTINUITY TYPE	SEVERITY LEVELS OR CLASSES
[_____]	[_____]
[_____]	[_____]

Use the applicable referenced standards as illustrated in ASTM E446. The evaluation of the radiographs will be subject to approval and all records become the property of the Government.

PART 3 EXECUTION

### 3.1 INSTALLATION

Thoroughly clean all parts to be installed. Remove packing compounds, rust, dirt, grit and other foreign matter. Clean holes and grooves for lubrication. Examine enclosed chambers or passages to make sure that they are free from damaging materials. Where units or items are shipped as assemblies they will be inspected prior to installation. Disassembly, cleaning and lubrication will not be required except where necessary to place the assembly in a clean and properly lubricated condition. Do not use pipe wrenches, cold chisels or other tools likely to cause damage to the surfaces of rods, nuts or other parts used for assembling and tightening parts. Tighten bolts and screws firmly and uniformly but take care not to overstress the threads. When a half nut is used for locking a full nut place the half nut first followed by the full nut. Lubricate threads of all bolts except high strength bolts, nuts and screws with an appropriate lubricant before assembly. Coat threads of corrosion-resisting steel bolts and nuts with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.

#### 3.1.1 Alignment and Setting

Accurately align each machinery or structural unit by the use of steel shims or other approved methods so that no binding in any moving parts or distortion of any member occurs before it is fastened in place. The alignment of all parts with respect to each other must be true within the respective tolerances required. Set true machines to the elevations shown.

#### 3.1.2 Blocking and Wedges

Remove all blocking and wedges used during installation for the support of parts to be grouted in foundations before final grouting unless otherwise directed. Blocking and wedges left in the foundations with approval must be of steel or iron.

#### 3.1.3 Foundations and Grouting

Provide concrete subbases and frames and final grout under parts of machines in accordance with the procedures as specified in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

### 3.2 TESTS

#### 3.2.1 Workmanship

Workmanship must be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished.

#### 3.2.2 Production Welding

Perform production welding conforming to the requirements of AWS D1.1/D1.1M or AWS D1.2/D1.2M, as applicable. Studs, on which pre-production testing is to be performed, must be welded in the same general position as required on production items (flat, vertical, overhead or sloping). Test and production stud welding will be subjected to visual examination or inspection. If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

### 3.3 PROTECTION OF FINISHED WORK

#### 3.3.1 Machined Surfaces

Thoroughly clean foreign matter off machined surfaces. Protect all finished surfaces. Oil and wrap unassembled pins and bolts with moisture resistant paper or protect them by other approved means. Wash finished surfaces of ferrous metals to be in bolted contact, with an approved rust inhibitor and coat them with an approved rust resisting compound for temporary protection during fabrication, shipping and storage periods. Paint finished surfaces of metals which will be exposed after installation, except corrosion resisting steel or nonferrous metals as specified in Section 09 97 02 PAINTING: HYDRAULIC STRUCTURES.

#### 3.3.2 Lubrication After Assembly

After assembly fill all lubricating systems with the appropriate lubricant and apply additional lubricant at intervals as required to maintain the equipment in satisfactory condition until acceptance of the work.

#### 3.3.3 Aluminum

Protect aluminum that will be in contact with grout or concrete from galvanic or corrosive action, with a coat of zinc-chromate primer and a coat of aluminum paint. Protect aluminum in contact with structural steel against galvanic or corrosive action with a coat of zinc-chromate primer and a coat of aluminum paint. Provide aluminum paint consisting of a aluminum paste conforming to ASTM D962, spar varnish and thinner compatible with the varnish. Field mix the aluminum paint in proportion of 2 pounds of paste, not more than one gallon of spar varnish and not more than one pint of thinner.

-- End of Section --

## SECTION 05 51 00

METAL STAIRS  
02/17, CHG 1: 05/17

## PART 1 GENERAL

[ Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.

]

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 314 (1990; R 2013) Standard Specification for  
Steel Anchor Bolts

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2016) Specification for Structural Steel  
Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121 (2007) Standard Definitions for Use in the  
Design of Steel Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts  
and Screws (Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping  
Screws, and Machine Drive Screws (Inch  
Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical  
Spring-Lock, Tooth Lock, and Plain Washers  
(Inch Series)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding  
Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A6/A6M (2021) Standard Specification for General  
Requirements for Rolled Structural Steel  
Bars, Plates, Shapes, and Sheet Piling

ASTM A27/A27M	(2020) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A29/A29M	(2020) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A512	(2006; R 2012) Standard Specification for Cold-Drawn Butt-weld Carbon Steel Mechanical Tubing
ASTM A568/A568M	(2019a) Standard Specification for Steel,

	Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM A575	(2020) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C514	(2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E488/E488M	(2022) Standard Test Methods for Strength of Anchors in Concrete Elements
ASTM F1679	(2004e1) Standard Test Method for Using a Variable Incidence Tribometer
	NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
NAAMM MBG 531	(2017) Metal Bar Grating Manual
	NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 101	(2021) Life Safety Code

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in

accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Iron and Steel Hardware; G[, [\_\_\_\_]]

Steel Shapes, Plates, Bars, and Strips; G[, [\_\_\_\_]]

Metal Stair System; G[, [\_\_\_\_]]

SD-03 Product Data

Structural Steel Plates, Shapes, and Bars; G[, [\_\_\_\_]]

Structural Steel Tubing; G[, [\_\_\_\_]]

Hot-Rolled Carbon Steel Sheets and Strips; G[, [\_\_\_\_]]

Cold-Finished Steel Bars; G[, [\_\_\_\_]]

Hot-Rolled Carbon Steel Bars; G[, [\_\_\_\_]]

Cold-Rolled Carbon Steel Sheets; G[, [\_\_\_\_]]

Galvanized Carbon Steel Sheets; G[, [\_\_\_\_]]

Cold-Drawn Steel Tubing; G[, [\_\_\_\_]]

Gray Iron Castings; G[, [\_\_\_\_]]

Malleable Iron Castings; G[, [\_\_\_\_]]

Concrete Inserts; G[, [\_\_\_\_]]

Masonry Anchorage Devices; G[, [\_\_\_\_]]

Protective Coating; G[, [\_\_\_\_]]

Steel Pan Stairs; G[, [\_\_\_\_]]

Steel Stairs; G[, [\_\_\_\_]]

Steel Stairs, Circular; G[, [\_\_\_\_]]

SD-07 Certificates

[ Welding Procedures; G[, [\_\_\_\_]]

] [ Welder Qualification; G[, [\_\_\_\_]]

] SD-08 Manufacturer's Instructions

Structural Steel Plates, Shapes, and Bars; G[, [\_\_\_\_]]

Structural Steel Tubing; G[, [\_\_\_\_]]

Hot-Rolled Carbon Steel Sheets and Strips; G[, [\_\_\_\_]]

Cold-Finished Steel Bars; G[, [\_\_\_\_]]



Hot-Rolled Carbon Steel Bars; G[, [\_\_\_\_]]

Cold-Rolled Carbon Steel Sheets; G[, [\_\_\_\_]]

Galvanized Carbon Steel Sheets; G[, [\_\_\_\_]]

Cold-Drawn Steel Tubing; G[, [\_\_\_\_]]

Gray Iron Castings; G[, [\_\_\_\_]]

Malleable Iron Castings; G[, [\_\_\_\_]]

Protective Coating; G[, [\_\_\_\_]]

Masonry Anchorage Devices; G[, [\_\_\_\_]]

### 1.3 QUALITY CONTROL

#### 1.3.1 Qualifications for Welding Work

[ Submit [welding procedures](#) in accordance with [AWS D1.1/D1.1M](#). Make test specimens in the presence of the Contracting Officer, and have the specimens tested by an approved testing laboratory at the Contractor's expense.

] [Certify [welder qualification](#) by tests in accordance with [AWS D1.1/D1.1M](#), or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, ensure that two test welds are retested immediately and that each test weld is made and passes. Failure in the immediate retest requires that the welder be retested after further practice or training and a complete set of test welds be made.

## ] PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Submit complete and detailed fabrication drawings for all [iron and steel hardware](#), and for all [steel shapes, plates, bars, and strips](#) used in accordance with the design specifications referenced in this section.

### 2.2 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning and treating surfaces and applying surface finishes, including zinc coatings.

#### 2.2.1 General Fabrication

Prepare and submit [metal stair system](#) shop drawings with detailed plans and elevations at scales not less than [1 inch to 1 foot](#) and with details of

sections and connections at scales not less than 3 inches to 1 foot. Also detail the placement drawings, diagrams, and templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchorage devices.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce a finished product that is strong enough and durable enough for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven methods of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and with straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flat-head (countersunk) screws or bolts.

Provide and coordinate anchorage of the type indicated for the supporting structure. Fabricate anchoring devices, and space them as indicated and as necessary to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

## 2.2.2 Steel Pan Stairs

### 2.2.2.1 General

Joining pieces by welding. Fabricate units so that bolts and other fastenings do not appear on finished surfaces. Make joints true and tight, and connections between parts lighttight. Grind continuous welds smooth where exposed.

Construct metal stair units to sizes and arrangements indicated to support a minimum live load of 100 pounds per square foot. Provide framing, hangers, columns, struts, clips, brackets, bearing plates, and other components as required for the support of stairs and platforms.

### 2.2.2.2 Stair Framing

Fabricate stringers of structural steel channels, or plates, or a combination thereof as indicated. Provide closures for exposed ends of strings.

Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels, and bolt framing members to stringers and headers.

### 2.2.2.3 Riser, Subtread, and Subplatform Metal Pans

- [ Form metal pans of 0.1084-inch (12-gage) structural steel sheets, conforming to ASTM A1011/A1011M, Grade 36. Shape the pans to the configuration indicated.
- ] [Form metal pans of 0.1084-inch (12-gage) galvanized structural steel sheets, conforming to ASTM A653/A653M, Grade A, with zinc coating conforming to ASTM A653/A653M and ASTM A924/A924M. Shape the pans to the configuration indicated.
- ] Construct risers and subread metal pans with steel angle supporting brackets, of the size indicated, welded to stringers. Secure metal pans to brackets with rivets or welds. Secure subplatform metal pans to platform frames with welds.

#### 2.2.2.4 Metal Safety Nosings

Between stringers, provide abrasive cast metal safety nosings, 4 inches wide by the full length of the step. Fabricate nosings to the thickness, profile, and surface pattern indicated. Equip each nosing with integral anchors for embedding in the pan fill material, and space the anchors not more than 4 inches from each end and not more than 15 inches on center.

#### 2.2.2.5 Steel Floor Plate Treads and Platforms

Provide raised-pattern steel floor plate fabricated from steel complying with ASTM A36/A36M. Provide the pattern indicated or, if not indicated, as selected from the manufacturer's standard patterns.

Form treads of 1/4-inch thick steel floor plate with integral nosing and back-edge stiffener. Weld steel supporting brackets to strings, and weld treads to brackets.

- [ Fabricate platforms of steel floor plate to the thickness indicated. Provide nosing that match treads at landings. Secure floor plates to platform framing members with welds.

#### ] 2.2.2.6 Safety Nosings for Concrete Treads

- [ Provide safety nosings of [cast aluminum] [cast iron] with [cross-hatched] [plain] abrasive surfaces, or extruded aluminum with abrasive inserts, at least 4 inches wide and 1/4 inch thick [and terminating at not more than 6 inches from the ends of treads] [for metal-pan cement-filled treads extending the full length of the tread] for stairs and [as indicated] for platforms and landings. Provide safety nosings with anchors embedded a minimum of 3/4 inch in the concrete and with tops flush with the top of the traffic surface.

#### ] 2.2.2.7 Safety Treads

- [ NAAMM MBG 531 [aluminum] [steel], Type [\_\_\_\_]] [Plank grating ASTM A653/A653M, G-90] [aluminum ASTM B209] [ASTM A1011/A1011M, steel pan for concrete tread.

#### ] 2.2.2.8 Steel Framing for Concrete Stairs

When necessary, modify fabricated units to fit actual dimensions of the supporting structure. Join steel components by welding. Provide 14-gage steel risers unless otherwise indicated. Arrange components to receive

finish materials as indicated.

### 2.2.3 Floor Grating Treads and Platforms

Provide floor grating treads and platforms conforming to [ASTM A6/A6M](#), [ASTM A29/A29M](#) and [NAAMM MBG 531](#), "Metal Bar Grating Manual." Provide the pattern, spacing, and bar sizes as indicated:

[ a. Galvanized finish, conforming to [ASTM A123/A123M](#).

] [b. Manufacturer's baked-on primer for painted finishes.

] Fabricate grating treads with steel plate nosings on one edge and with steel angle or steel plate carriers at each end for string connections. Secure treads to strings with bolts.

Match the nosings of grating platforms with the nosing of grating treads at landings. Provide toeplates where the open-sided edges of floor grating meet platform framing members.

### 2.2.4 Protective Coating

[ Shop-prime steelwork as indicated in accordance with [[AISC/AISI 121](#)] [Section [09 97 13.00 40](#) STEEL COATINGS], except surfaces of steel encased in concrete; welded surfaces; high-strength, bolt-connected surfaces; and surfaces of crane rails.

] [Hot-dip galvanize steelwork as indicated in accordance with [ASTM A123/A123M](#). Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

## ] 2.3 COMPONENTS

### 2.3.1 Steel Stairs

Provide steel stairs complete with stringers, [steel-plate treads and risers,] [metal-pan concrete-filled treads,] [grating treads,] [nonskid metallic treads,] [precast concrete treads,] landings, columns, handrails, and necessary bolts and other fastenings. [Hot-dip-galvanize] [Shop-paint] steel stairs and accessories.

#### 2.3.1.1 Design Loads

Design stairs to sustain a live load of not less than [\_\_\_\_\_] pounds per square foot, or a concentrated load of [\_\_\_\_\_] applied where it is most critical. Except for a commercial product, design and fabricate steel stairs to conform to [AISC 360](#). [Design fire stairs to conform to [NFPA 101](#).]

#### 2.3.1.2 Materials

Provide steel stairs of welded construction except that bolts may be used where welding is not practicable. Do not use screw or screw-type connections.

a. Structural Steel: [ASTM A36/A36M](#).

b. Gratings for Treads and Landings: [[NAAMM MBG 531](#)] [or] [Plank grating; [ASTM A653/A653M](#), G-90 for steel; [ASTM B209](#) for aluminum.] [Provide gratings with nonslip nosings.] [with slip resistance exceeding a

static coefficient of friction, both wet and dry, of [0.5] [0.6] as tested in accordance with [ASTM F1679](#).]

- c. Support [steel floor plate] [metal pan for concrete fill] [steel grating] on angle cleats welded to stringers or treads with integral cleats, welded or bolted to the stringer. [Provide sheet-steel landings with angle stiffeners welded on.] Close exposed ends. [For exterior stairs, form all exposed joints to exclude water.]
- [ d. Ensure that precast concrete treads are factory-built as specified in Section [03 45 33](#) PRECAST[ PRESTRESSED] STRUCTURAL CONCRETE.
- ] e. Before fabrication, obtain necessary field measurements and verify drawing dimensions.
- f. Clean metal surfaces free of mill scale, flake rust, and rust pitting before shop finishing. Weld permanent connections. Finish welds flush and smooth on surfaces that will be exposed after installation.

### 2.3.2 Steel Stairs, Circular

Provide standard open riser constructed of steel, with a minimum outside diameter of [6 feet](#) and with 12 treads to the circle. Construct the center pole from one continuous length of circular, cold-drawn, seamless tube with a minimum outside diameter of [3 1/2 inches](#) and with caps at the top plate and base plate having countersunk machine screws and expansion shields for fastening to the concrete floor slab. Construct treads and platforms from steel grating conforming to [NAAMM MBG 531](#). [Provide nonslip nosings for gratings.] [Design slip-resistant gratings to exceed a static coefficient of friction of 0.5 [0.6] as tested in accordance with [ASTM F1679](#).]

### 2.3.3 Soffit Clips

Provide clips with holes for attaching metal furring for plastered soffits. Space the clips not more than [12 inches](#) on center, and weld them to stair treads and platforms as required.

### 2.3.4 Concrete Inserts

- [ Threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive [3/4-inch](#) diameter machine bolts; either malleable iron conforming to [ASTM A47/A47M](#) or cast steel conforming to [ASTM A27/A27M](#), and hot-dip-galvanized in accordance with [ASTM A153/A153M](#).
- ] [Wedge-type concrete inserts consisting of galvanized box-type ferrous castings designed to accept [3/4-inch](#) diameter bolts having special wedge-shaped heads; either malleable iron conforming to [ASTM A47/A47M](#) or cast steel conforming to [ASTM A27/A27M](#) and hot-dip-galvanized in accordance with [ASTM A153/A153M](#).
- ] [Carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims and galvanized in accordance with [ASTM A153/A153M](#). Provide slotted-type concrete inserts consisting of galvanized [1/8-inch](#) thick pressed steel plate conforming to [ASTM A283/A283M](#); of box-type welded construction with slot designed to receive [3/4-inch](#) diameter square-head bolt with knockout cover; and be hot-dip-galvanized in accordance with [ASTM A123/A123M](#).

### ]2.3.5 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

- [ a. Lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded-nut type, single unit class, Group I, Type 1, Class 1.
- ] [b. Lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded-nut type, multiple unit class, Group I, Type 1, Class 2.
- ] [c. Bolt anchor expansion shields for lag bolts; zinc-alloy, long-shield anchors class, Group II, Type 1, Class 1.
- ] [d. Bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.
- ] Use toggle bolts of the tumble-wing type, conforming to ASTM A325, ASTM A449, and ASTM C636/C636M, type, class, and style as required.

#### 2.3.6 Fasteners

Select galvanized zinc-coated fasteners conforming to ASTM A153/A153M for exterior applications or where the fasteners are built into exterior walls or floor systems. Select the fasteners for the type, grade, and class required for the installation of steel stair items:

- a. Standard/regular hexagon-head bolts and nuts, conforming to ASTM A307, Grade A.
- b. Square-head lag bolts conforming to ASME B18.2.1.
- c. Cadmium-plated steel machine screws, conforming to ASME B18.6.3.
- d. Flat-head carbon steel wood screws, conforming to ASME B18.6.1.
- e. Plain, round, general-assembly-grade, carbon steel washers, conforming to ASME B18.21.1.
- f. Helical-spring, carbon steel lockwashers, conforming to ASME B18.2.1.

#### 2.4 MATERIALS

##### 2.4.1 Structural Steel Plates, Shapes and Bars

Structural size shapes and plates, conforming to ASTM A36/A36M, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M, unless otherwise noted for steel bars and bar-size shapes.

##### 2.4.2 Structural Steel Tubing

Provide the following:

- [ a. Structural steel tubing, hot-formed, welded or seamless, conforming to

ASTM A500/A500M, Grade B, unless otherwise noted.

] [Structural steel tubing, hot-formed, welded or seamless, conforming to [\_\_\_\_\_] Grade [\_\_\_\_\_].

#### ] 2.4.3 Hot-Rolled Carbon Steel Bars

Provide the following:

[ a. Hot-rolled carbon steel bars and bar-size shapes, conforming to ASTM A575, grade as selected by the fabricator.

] [b. Hot-rolled carbon steel bars and bar-size shapes, conforming to [\_\_\_\_\_], grade as selected by the fabricator.

#### ] 2.4.4 Cold-Finished Steel Bars

Provide the following:

[ a. Cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

] [b. Cold-finished steel bars conforming to [\_\_\_\_\_], grade as selected by the fabricator.

#### ] 2.4.5 Hot-Rolled Carbon Steel Sheets and Strips

Provide the following:

[ a. Hot-rolled carbon sheets and strips conforming to ASTM A568/A568M and ASTM A1011/A1011M, pickled and oiled.

] [b. Hot-rolled carbon sheets and strips conforming to [\_\_\_\_\_].

#### ] 2.4.6 Cold-Rolled Carbon Steel Sheets

Provide the following:

[ a. Cold-rolled carbon steel sheets conforming to ASTM A1008/A1008M.

] [b. Cold-rolled carbon steel sheets conforming to [\_\_\_\_\_].

#### ] 2.4.7 Galvanized Carbon Steel Sheets

Provide the following:

[ a. Galvanized carbon steel sheets conforming to ASTM A653/A653M, with galvanizing conforming to ASTM A653/A653M and ASTM A924/A924M.

] [b. Galvanized carbon steel sheets conforming to [\_\_\_\_\_], with galvanizing conforming to [\_\_\_\_\_].

#### ] 2.4.8 Cold-Drawn Steel Tubing

Provide the following:

[ a. Cold-drawn steel tubing conforming to ASTM A512, sunk drawn, butt-welded, cold-finished, and stress-relieved.

] [b. Cold-drawn steel tubing conforming to [\_\_\_\_], [\_\_\_\_].

#### ] 2.4.9 Gray Iron Castings

Provide the following:

[ a. Gray iron castings conforming to ASTM A48/A48M, Class 30.

] [b. Gray iron castings conforming to [\_\_\_\_], Class [\_\_\_\_].

#### ] 2.4.10 Malleable Iron Castings

Provide the following:

[ a. Malleable iron castings conforming to ASTM A47/A47M, grade as selected.

] [b. Malleable iron castings conforming to [\_\_\_\_], grade as selected.

#### ] 2.4.11 Steel Pipe

Provide the following:

[ a. Steel pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

] [b. Steel pipe conforming to [\_\_\_\_], type as selected, Grade [\_\_\_\_]; primed finish, unless galvanizing is required; [standard weight (Schedule 40)] [\_\_\_\_].

### ] PART 3 EXECUTION

#### 3.1 PREPARATION

Clean surfaces thoroughly before installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

Protect installed products until completion of project. Touch up, repair or replace, damaged products before substantial completion

#### 3.2 INSTALLATION

Install in accordance with the manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

Install items at locations indicated, according to the manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Ensure that exposed fastenings are compatible with generally match the color and finish of, and harmonize with the material to which they are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Select thickness of metal and details of assembly and supports that adequately strengthen and stiffen the construction. Form joints exposed to the weather to exclude water.



### 3.2.1 Field Preparation

Remove rust-preventive coating just before field erection, using a remover approved by the coating manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

### 3.2.2 Field Welding

Comply with [AWS D1.1/D1.1M](#) in executing manual shielded-metal arc welding, (for appearance and quality of new welds) and in correcting existing welding.

### 3.2.3 Safety Nosings

Completely embed nosing in concrete before the initial set of the concrete occurs and finish flush with the top of the concrete surface.

### 3.2.4 Touchup Painting

Immediately after installation, clean all field welds, bolted connections, and abraded areas of the shop-painted material, and repaint exposed areas with the same paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of [2 mils](#).

-- End of Section --

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## SECTION 05 51 33

## METAL LADDERS

02/16, CHG 2: 02/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN LADDER INSTITUTE (ALI)

ALI A14.3 (2008; R 2018) Ladders - Fixed - Safety Requirements

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z359.16 (2016) Safety Requirements for Climbing Ladder Fall Arrest Systems

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A53/A53M (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A500/A500M (2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
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SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.23	(Nov 2016) Ladders
29 CFR 1910.28	(Nov 2016) Duty to Have Fall Protection and Falling Object Protection
29 CFR 1910.29	(Nov 2016) Fall Protection System and Falling Object Protection - Criteria and Practices

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will

review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Ladders, Installation Drawings

Ship's Ladder (With or Without Guards), Installation Drawings

#### SD-03 Product Data

Ladders

Ship's Ladder (With or Without Guards)

Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

#### SD-07 Certificates

Fabricator Certification for Ladder Assembly

Fabricator Certification for Ships Ladder Assembly

### 1.3 CERTIFICATES

Provide fabricator certification for ladder assembly stating that the ladder and associated components have been fabricated according to the requirements of 29 CFR 1910.23.

Provide fabricator certification for ships ladder assembly stating that the ships ladder and associated components have been fabricated according to the requirements of 29 CFR 1910.23.

### 1.4 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

### 1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Structural Carbon Steel

ASTM A36/A36M.

#### 2.1.2 Structural Tubing

ASTM A500/A500M.

#### 2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

#### 2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings [ASTM A47/A47M](#).

#### 2.1.5 Aluminum Alloy Products

Conform to [ASTM B209](#) for sheet plate, [ASTM B221](#) for extrusions and [ASTM B26/B26M](#) or [ASTM B108/B108M](#) for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

### 2.2 FABRICATION FINISHES

#### 2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: [ASTM A123/A123M](#), [ASTM A153/A153M](#), [ASTM A653/A653M](#) or [ASTM A924/A924M](#), G90, as applicable.

#### 2.2.2 Galvanize

Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

#### 2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to [ASTM A780/A780M](#) or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

#### 2.2.4 Shop Cleaning and Painting

##### 2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with [SSPC SP 6/NACE No.3](#). Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with [SSPC SP 3](#) in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean.

##### 2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. [ On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.]

#### 2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

## 2.2.6 Aluminum Surfaces

### 2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

### 2.2.6.2 Aluminum Finishes

Unexposed plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with [standard mill finish.] [hand sanded or machine finish to a 240 grit.] Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45.

## 2.3 LADDERS

Fabricate vertical ladders conforming to 29 CFR 1910.23 and Section 5 of ALI A14.3. Ladders shall be capable of supporting their maximum intended load. Use 2 1/2 by 3/8 inch steel flats for stringers and 3/4 inch diameter steel rods for rungs. Ladder rungs, step and cleats must be spaced not less than 10 inches and not more than 16 inches wide (measured before installation of ladder safety system), spaced no more than 14 inches apart, plug welded or shouldered and headed into stringers. Install ladders so that the maximum perpendicular distance from the centerline of the steps or rungs, or grab bars, or both, to the nearest permanent object in the back of the ladder or to the finished wall surface will not be less than 7 inches, except for the elevator pit ladders, which have a minimum perpendicular distance of 4.5 inches. Provide heavy clip angles riveted or bolted to the stringer and drilled [for not less than two 1/2 inch diameter expansion bolts] as indicated. Provide intermediate clip angles not over 48 inches on centers. The top rung of the ladder must be level with the top of the access level, parapet or landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 42 inches above the access level. Provide ladder access protective swing gates at the top of access/egress level. The drawings must indicate ladder locations and details of critical dimensions and materials.

### 2.3.1 Phasing out of Ladder Cages and Wells (29 CFR 1910.28, Nov 2016)

Conform to 29 CFR 1910.28 (Nov 2016).

- [ Each ladder installed before 19 November, 2018 shall be equipped with a personal fall arrest system, ladder safety device (climbing Ladder Fall Arrest System), cage, or well.
- ] Each newly installed ladder over 20 feet in length shall only be equipped with a personal fall arrest system or climbing ladder fall arrest system (ladder safety device), cages and wells are prohibited. When a fixed ladder, cage, or well, or any portion of a section thereof, is replaced, a personal fall arrest system or climbing ladder fall arrest system (ladder safety device) is installed in at least that section of the fixed ladder, cage, or well where the replacement is located. On and after November 18, 2036, all fixed ladders shall only be equipped with a personal fall arrest system or a ladder safety device (climbing ladder Fall Arrest System).

### 2.3.2 Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

Conform to 29 CFR 1910.29, Section 7 of ALI A14.3 and ASSP Z359.16. Install ladder safety devices on ladders over 20 feet long or more. The ladder safety systems must meet the design requirement of the ladders which they serve. The ladder safety system must be capable of sustaining a minimum static load of 1,000 pounds. The applied loads transferred to the climbing ladder mounting locations as a result of a fall shall be specified by the manufacturer of the climbing ladder fall arrest system. Each ladder safety system must allow the worker to climb up and down using both hands and does not require the employee continuously, hold, push, or pull any part of the system while climbing. The connection between the carrier or lifeline and the point of attachment to the body harness does not exceed 9 inches. The ladder safety system consists of a rigid or flexible carrier. Mountings for the rigid carriers are attached at each end of the carrier, with intermediate mountings spaced as necessary, along the entire length of the carrier. Mountings for flexible carrier are attached at each end of the carrier and cable guides for flexible carriers are installed at least 25 feet apart but not more than 40 feet apart along the entire length of the carrier. The design and installation of mountings and cable guides does not reduce the design strength of the ladder.

### 2.3.3 Ship's Ladder

Fabricate stringers and framing of steel plate or shapes. Bolt, rivet or weld connections and anchor to supporting construction. Provide treads with non-slip surface as specified for safety treads. [Aluminum ladders may be provided, subject to approval of treads, materials, and shop drawings. Requirements shown or specified for steel apply. Provide anchor items of zinc-coated steel.] Design assembly, including tread connections and methods of attachment, to support a live load of 300 pounds per tread. Provide railings as specified for metal handrails.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide Exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

### 3.2 WORKMANSHIP

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Do not tack weld exposed connections of work in place. Grid smooth exposed welds. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved



drawings, cuts, and details.

### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

### 3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with [AWS D1.1/D1.1M](#). Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

### 3.5 FINISHES

#### 3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to [MPI 79](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with [ASTM D1187/D1187M](#), asphalt-base emulsion.

#### 3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

#### 3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than [5 degrees F](#) above the dew point of the surrounding air, or when surface temperature is below [45 degrees F](#) or over [95 degrees F](#), unless approved by the Contracting Officer.

### 3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. [ Secure to masonry or concrete with not less than two [1/2 inch](#) diameter expansion bolts.] Install intermediate clip angles not over [48 inches](#) on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. Ends of ladders must not rest upon [finished roof][floor].

-- End of Section --

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## SECTION 05 52 00

METAL RAILINGS  
02/18, CHG 1: 02/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 180 (2012; R 2017) Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail

AASHTO M 314 (1990; R 2013) Standard Specification for Steel Anchor Bolts

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M (2020) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A53/A53M (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A467/A467M	(2020) Standard Specification for Machine Coil Chain
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A512	(2006; R 2012) Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing
ASTM A575	(2020) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B429/B429M	(2010; E 2012) Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C514	(2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E488/E488M	(2022) Standard Test Methods for Strength

## of Anchors in Concrete Elements

## ASTM F3125/F3125M

(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

## NAAMM AMP 521

(2001; R 2012) Pipe Railing Systems Manual

## 1.2 ADMINISTRATIVE REQUIREMENTS

## 1.2.1 Preinstallation Meetings

Within [30] [\_\_\_\_\_] days of contract award, submit [fabrication drawings](#) [to the Contracting Officer] for the following items:

- [ a. Iron and steel hardware
- ] [b. Steel shapes, plates, bars and strips
- ] [c. Steel railings and handrails
- ] [d. Aluminum railings and handrails
- ] e. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

- [ a. Structural-steel plates, shapes, and bars
- ] [b. Structural-steel tubing
- ] [c. Cold-finished steel bars
- ] [d. Hot-rolled carbon steel bars
- ] [e. Cold-drawn steel tubing
- ] [f. Concrete inserts
- ] [g. Masonry anchorage devices
- ] [h. Protective coating
- ] [i. Steel railings and handrails
- ] [j. Aluminum railings and handrails
- ] k. [Anchorage and fastening systems](#)

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Fabrication Drawings; G[, [\_\_\_\_]]

Iron and Steel Hardware; G[, [\_\_\_\_]]

Steel Shapes, Plates, Bars and Strips; G[, [\_\_\_\_]]

#### SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars; G[, [\_\_\_\_]]

Structural-Steel Tubing; G[, [\_\_\_\_]]

Cold-Finished Steel Bars; G[, [\_\_\_\_]]

Hot-Rolled Carbon Steel Bars; G[, [\_\_\_\_]]

Cold-Drawn Steel Tubing; G[, [\_\_\_\_]]

Concrete Inserts; G[, [\_\_\_\_]]

Masonry Anchorage Devices; G[, [\_\_\_\_]]

Protective Coating; G[, [\_\_\_\_]]

Steel Railings and Handrails; G[, [\_\_\_\_]]

Aluminum Railings and Handrails; G[, [\_\_\_\_]]

Anchorage and Fastening Systems; G[, [\_\_\_\_]]

#### SD-07 Certificates

Welding Procedures; G[, [\_\_\_\_]]

Welder Qualification; G[, [\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Installation Instructions

### 1.4 QUALITY CONTROL

#### 1.4.1 Welding Procedures

[ Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.

] Submit results of welding procedures testing in accordance with AWS D1.1/D1.1M made in the presence of the Contracting Officer and by an approved testing laboratory at the Contractor's expense.

#### 1.4.2 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

### PART 2 PRODUCTS

#### 2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 inch to 1 foot. Provide details of sections and connections at not less than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is

indicated or specified to be fabricated from cold-finished or cold-rolled stock.

#### 2.1.1 Aluminum Railings

Fabrication: Provide fabrication jointing by one of the following methods:

- a. Use flush-type rail fittings, welded and ground smooth with splice locks secured with  $3/8$  inch recessed-head set screws.
- b. Ensure that mitered and welded joints made by fitting; post to top rail; intermediate rail to post; and corners, are groove welded and ground smooth. Where allowed by the Contracting Officer, provide butt splices reinforced by a tight-fitting dowel or sleeve not less than 6 inches in length. Tack-weld or epoxy-cement the dowel or sleeve to one side of the splice.
- c. Assemble railings using slip-on aluminum-magnesium alloy fittings for joints. Fasten fittings to pipe or tube with  $1/4$  or  $3/8$  inch stainless-steel recessed-head setscrews. Provide assembled railings with fittings only at vertical supports or at rail terminations attached to walls. Provide expansion joints at the midpoint of panels. Provide a setscrew in only one side of the slip-on sleeve. Provide alloy fittings to conform to ASTM B26/B26M.

[ Provide removable railing sections as indicated. [Provide toe-boards and brackets where indicated, using flange castings as appropriate.]

#### ]2.1.2 Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

- a. Flush-type rail fittings of commercial standard, welded and ground smooth, with railing splice locks secured with  $3/8$  inch hexagonal-recessed-head setscrews.
- b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 6 inches long.
- c. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

[ Provide removable sections as indicated.

#### ]2.1.3 Protective Coating

[ Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

- a. steel surfaces encased in concrete
- b. steel surfaces for welding
- c. high-strength bolt-connected contact surfaces
- d. crane rail surfaces



] [Provide hot-dipped galvanized steelwork as indicated in accordance with [ASTM A123/A123M](#). Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

] ] 2.2 COMPONENTS

] [2.2.1 [Structural Steel Plates, Shapes And Bars](#)

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to [ASTM A36/A36M](#), unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to [ASTM A283/A283M](#), Grade C.

Provide steel bars and bar-size shapes conforming to [ASTM A36/A36M](#), unless otherwise noted.

] [2.2.2 [Structural-Steel Tubing](#)

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to [ASTM A500/A500M](#), Grade B, unless otherwise noted.

] [2.2.3 [Hot-Rolled Carbon Steel Bars](#)

Provide bars and bar-size shapes conforming to [ASTM A575](#), grade as selected by the fabricator.

] [2.2.4 [Cold-Finished Steel Bars](#)

Provide cold-finished steel bars conforming to [ASTM A108](#), grade as selected by the fabricator.

] [2.2.5 [Cold-Drawn Steel Tubing](#)

Provide tubing conforming to [ASTM A512](#), sunk-drawn, butt-welded, cold-finished, and stress-relieved.

] [2.2.6 [Steel Pipe](#)

Provide pipe conforming to [ASTM A53/A53M](#), type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

] [2.2.7 [Concrete Inserts](#)

[ Provide threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts; either malleable iron conforming to [ASTM A47/A47M](#) or cast steel conforming to [ASTM A27/A27M](#), hot-dip galvanized in accordance with [ASTM A153/A153M](#).

] [Provide wedge-type concrete inserts consisting of galvanized box-type ferrous castings designed to accept 3/4 inch diameter bolts having special wedge-shaped heads, made of either malleable iron conforming to [ASTM A47/A47M](#) or cast steel conforming to [ASTM A27/A27M](#) and hot-dip galvanized in accordance with [ASTM A153/A153M](#).

] [Provide carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims, galvanized in accordance with [ASTM A153/A153M](#). Provide slotted-type concrete inserts consisting of a galvanized 1/8 inch thick

pressed-steel plate conforming to [ASTM A283/A283M](#), made of box-type welded construction with a slot designed to receive  $3/4$  inch diameter square-head bolt with knockout cover; and hot-dip galvanized in accordance with [ASTM A123/A123M](#).

#### ]] [2.2.8 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with [AASHTO M 314](#), [ASTM E488/E488M](#) and [ASTM C514](#) as follows:

- [ Provide lead expansion shields for machine screws and bolts  $1/4$  inch and smaller; head-out embedded nut type, single-unit class, Group I, Type 1, Class 1.
- ] [ Provide lead expansion shields for machine screws and bolts larger than  $1/4$  inch in size; head-out embedded nut type, multiple-unit class, Group I, Type 1, Class 2.
- ] [ Provide bolt anchor expansion shields for lag bolts; zinc-alloy, long-shield anchor class, Group II, Type 1, Class 1.
- ] [ Provide bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.
- ] [ Provide tumble-wing-type toggle bolts conforming to [ASTM F3125/F3125M](#), [ASTM A449](#) and [ASTM C636/C636M](#), type, class, and style as required.

#### ] [2.2.9 Fasteners

Provide galvanized zinc-coated fasteners in accordance with [ASTM A153/A153M](#) used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

- [ Provide standard hexagon-head bolts, conforming to [ASTM A307](#), Grade A.
- ] [Provide square-head lag bolts conforming to [ASME B18.2.1](#).
- ] [Provide cadmium-plated steel machine screws conforming to [ASME B18.6.3](#).
- ] [Provide flat-head carbon steel wood screws conforming to [ASME B18.6.1](#).
- ] [Provide plain round, general-assembly-grade, carbon steel washers conforming to [ASME B18.21.1](#).
- ] [Provide helical spring, carbon steel lockwashers conforming to [ASME B18.2.1](#).

#### ]] [2.2.10 Steel Railings And Handrails

Design handrails to resist a concentrated load of [ ] [ 200 lb] [\_\_\_\_\_] in any direction at any point of the top of the rail or [ ] [ 50 lb per foot] [\_\_\_\_\_] applied horizontally to the top of the rail, whichever is more severe. [NAAMM AMP 521](#), provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts. [Provide series 300 stainless-steel pipe collars.]

##### 2.2.10.1 Steel Handrails

Provide steel handrails, including inserts in concrete, [steel pipe

conforming to [ASTM A53/A53M](#)] [or] [structural tubing conforming to [ASTM A500/A500M](#), Grade A or B of equivalent strength]. Provide steel railings of [1 1/2] [2] inch nominal size, [hot-dip galvanized] [and] [shop-painted].

Provide kickplates between railing posts where indicated, and consisting of 1/8 inch steel flat bars not less than 6 inches high. Secure kickplates as indicated.

[ Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings.

] [Provide galvanized exterior and interior railings where indicated, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings not indicated as galvanized.

] [Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

#### ]] [2.2.11 Aluminum Railings And Handrails

Provide railings and handrails consisting of [ 1 1/2] [2] inch nominal schedule 40 pipe [ASTM B429/B429M](#)], [ 1 3/4 inch square aluminum semihollow tube with rounded corners [ASTM B221](#)]. Provide [mill-finish] [anodized] aluminum [[\_\_\_\_\_] color] railings. Ensure that all fasteners are Series 300 stainless steel.

#### ] 2.2.12 Safety Chains [And Guardrails]

Provide safety chains of galvanized steel, straight-link type, 3/16 inch diameter, with at least 12 links per foot, and with snap hooks on each end. Test safety chain in accordance with [ASTM A467/A467M](#), Class CS. Provide snap hooks of boat type. Provide galvanized 3/8 inch bolt with 3/4 inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 4 inches longer than the anchorage spacing, for each guarded area. [Provide corrugated sheet steel beam guardrail conforming to the requirements of [AASHTO M 180](#), Type [\_\_\_\_\_] of the class specified on the drawings. Provide bolts and nuts as indicated, conforming to the requirements of [ASTM A307](#).] Locate [guardrails] safety chain where indicated. Mount the top chain [rail] feet 6 inches [\_\_\_\_\_] above the [floor] [ground] and mount the lower chain [rail] 2 feet [\_\_\_\_\_] above the [floor] [ground].

### PART 3 EXECUTION

#### 3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than [8 feet] [\_\_\_\_\_] on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

- [ a. Anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 6 inches long, and having an inside diameter not less than 1/2 inch greater than the outside diameter of the inserted pipe post.

Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 1 inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with nonshrink grout or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

- ] [b. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.
- ] [c. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.
- ] [d. Anchor rail ends to steel with oval or round steel flanges welded to tail ends and bolted to the structural-steel members.
- ] Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 3 inch projection from the finished wall surface to the center of the pipe, drilled to receive one 3/8 inch bolt. Locate brackets not more than 60 inches on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:
  - [ a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
  - ] [b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.
- ] Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

### 3.2 INSTALLATION

Submit manufacturer's [installation instructions](#) for the following products to be used in the fabrication of [steel] [\_\_\_\_\_] [stair railing] [and] [hand rail work]:

- [ a. Structural-steel plates, shapes, and bars
- ] [b. Structural-steel tubing
- ] [c. Cold-finished steel bars
- ] [d. Hot-rolled carbon steel bars
- ] [e. Cold-drawn steel tubing
- ] [f. Protective coating
- ] [g. Masonry anchorage devices
- ] [h. Steel railings and handrails
- ] [i. Aluminum railings and handrails

## ] [j. Anchorage and fastening systems

] Provide complete, detailed fabrication and installation drawings for all [iron and steel hardware](#), and for all [steel shapes, plates, bars, and strips](#) used in accordance with the design specifications cited in this section.

## [3.2.1 Steel Handrail

Install handrail [in pipe sleeves embedded in concrete and filled with nonshrink grout or quick-setting anchoring cement with anchorage covered with standard pipe collar pinned to post.] [by means of pipe sleeves secured to wood with screws.] [by means of masonry with expansion shields and bolts or toggle bolts.] [by means of base plates bolted to stringers or structural-steel frame work.] Secure rail ends by steel pipe flanges [anchored by expansion shields and bolts.] [through-bolted to a back plate or by  $1/4$  inch lag bolts to studs or solid backing.]

## ] [3.2.2 Aluminum Handrail

Affix to base structure by [flanges anchored to concrete or other existing masonry by expansion shields] [base plates or flanges bolted to stringers or structural-steel framework] [flanges through-bolted to a backing plate on the other side of a wall] [flanges lag-bolted to studs or other structural timbers]. Provide Series 300 stainless-steel bolts to anchor aluminum alloy flanges, of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or concrete, coat the contact surface with a heavy coating of bituminous paint.

## ] [3.2.3 Touchup Painting

Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of [2 mils](#).

## ] 3.3 FIELD QUALITY CONTROL

## 3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with [AWS D1.1/D1.1M](#).

-- End of Section --

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## SECTION 05 59 10

## ROLLING COVER FOR AVIATION REFUELING VAULTS

08/18

## PART 1 GENERAL

This specification covers the factory fabrication, assembly, testing, and shipping requirements for custom fabricated rolling covers having steel or aluminum shells as indicated in the vault schedule on the vault drawings. Covers are to be field installed on variously sized new and/or existing hydrant fueling system vaults and tanks.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA ADM (2020) Aluminum Design Manual

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B4.1 (1967; R 1994; R 2004; R 2009; R 2020) Preferred Limits and Fits for Cylindrical Parts

ASME B46.1 (2020) Surface Texture, Surface Roughness, Waviness and Lay

ASME BPVC SEC IX (2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A276/A276M (2017) Standard Specification for Stainless Steel Bars and Shapes

ASTM A307 (2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60

000 PSI Tensile Strength

ASTM A563

(2015) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A1085/A1085M

(2015) Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)

ASTM B209

(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

## 1.2 ADMINISTRATIVE REQUIREMENTS

Submit manufacturer's catalogue cuts and dimensional sheets. Include a description of the item, materials of construction, and dimensions. Provide data sufficient to indicate compliance with specifications. Mark items pertaining to specifications with a heavy black arrow.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Assembly Tests; G[, [\_\_\_\_\_]]

Acceptance Testing; G[, [\_\_\_\_\_]]

### SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_\_]]

### SD-03 Product Data

Wheel Assemblies; G[, [\_\_\_\_\_]]

Materials List; G[, [\_\_\_\_\_]]

Welding; G[, [\_\_\_\_\_]]

Welding of Aluminum; G[, [\_\_\_\_\_]]

Steel Welding Repairs; G[, [\_\_\_\_\_]]

### SD-07 Certificates

Welder Qualifications

Welding of Aluminum

## 1.4 QUALITY ASSURANCE

### 1.4.1 Welder Qualifications



Submit certification stating that the welders, welding operators, and tack welders who will perform structural steel welding, have been qualified for the particular type of work to be done, in accordance with the requirements of [AWS D1.1/D1.1M](#), Section 4, prior to commencing fabrication. The certificate must list the qualified welders by name and must specify the code and procedures for which they are qualified and the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which they have been qualified, within the preceding three months. Require welders to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those passing the requalification tests will be recertified. Those not passing will be disqualified until passing. All expenses in connection with qualification and requalification must be borne by the Contractor.

#### 1.4.2 Workmanship

Workmanship must be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished. Welding must be continuous along the entire area of contact, except where tack welding is permitted. Exposed connections of work in place must not be tack welded. Exposed welds must be ground smooth. Exposed surfaces of work in place must have a smooth finish.

#### 1.4.3 Detail Drawings

Submit detail drawings for metalwork and machine work prior to fabrication. Submit a [materials list](#) for fabricated items with the detail drawings. Detail drawings for metalwork and machine work must include catalog cuts, templates, fabrication and assembly details, and type, grade, and class of material as appropriate. Also include a sketch showing final wheel to axle mounting (i.e., washers, nuts, spacers). Elements of fabricated items inadvertently omitted on contract drawings must be detailed by the fabricator and indicated on the detail drawings. Drawings must include all dimensional and tolerance data for each size of vault being fabricated.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

##### 2.1.1 Bolts and Cap Screws

All bolts must be steel and must conform to [ASTM A307](#), Grade A, Hex.

##### 2.1.2 Nuts

Must conform to [ASTM A563](#), Grade A, Hex, and must be of the same finish as the fasteners they are used with.

##### 2.1.3 Washers

Flat washers must conform to the requirements of [ASTM A276/A276M](#) (stainless steel).

##### 2.1.4 Tube Steel

Structural tubing must conform to [ASTM A1085/A1085M](#).

### 2.1.5 Structural Steel

Carbon steel must conform to [ASTM A36/A36M](#)

### 2.1.6 Rolling Cover Shell

Cover shell material must be as indicated on the drawings and specified as follows:

#### 2.1.6.1 Aluminum

Aluminum sheets and strips must comply with [ASTM B209](#), alloy and temper best suited for the purpose.

### 2.1.7 Wheel Assemblies

#### 2.1.7.1 Wheels

Provide the heavy duty industrial type that is the product of a company regularly engaged in the production of wheels. The wheels must have solid rubber tires that are molded onto spoked or solid centers that are either cast, forged, or machined. The rubber must have a hardness rating of 80-90 Shore A durometer. Tires must not stretch or work loose from the metal center. The wheels must have roller bearings and must be pressure lubricated from a grease fitting when available. The wheels must work in a temperature range of -40 to +180 degrees F. The entire wheel assembly must be symmetrical and must spin concentrically around the bearing. Finish metal centers with either an epoxy paint, a powder coating, or manufacture galvanized. The diameter of the carrier wheels must be 6 inches and the diameter of the side wheels must be 3-1/4 inches. The fabricator must use appropriate washers and spacers to lock the inner bearing bushing to the axle. Wheels must be similar or equal to the following:

- a. 6 inches Dia. x 2 inches wide
- b. 3-1/4 inches Dia. x 1-1/2 inches wide

#### 2.1.7.2 Axles

The axle assembly must be stainless steel and must be eccentrically machined. A slotted adjustment cam plate must be attached to the axle by welding, as indicated on the drawings. Eccentric offset must be a minimum of 1/4-inch. Diameter, tolerance, and finish of the mating axle shaft must be coordinated with the wheel manufacturer's diameters and tolerances for a close fit. Submit shop drawings showing all fits and tolerances. Material, weld, and nut must all be a 300 series stainless steel.

## 2.2 FABRICATION

### 2.2.1 General

Material must be straight before being laid off or worked. If straightening is necessary, it must be done by methods that will not impair the metal. Sharp kinks or bends must be cause for rejection of the material. Material with welds will not be accepted, except where welding is definitely specified, indicated, or otherwise approved. Bends must be made by approved dies, press brakes, or bending rolls. Where heating is required, precautions must be taken to avoid overheating or warping the

metal, and it must be allowed to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material other than structural steel must be subject to approval and must be indicated on detail drawings. Shearing must be accurate, and all portions of the work must be neatly finished. Corners must be square and true unless otherwise shown on the drawings. Re-entrant cuts must be filleted to a minimum radius of  $3/4$  inch unless otherwise approved. Finished members must be free of twists, bends, and open joints. Bolts, nuts, and screws must be tight.

#### 2.2.2 Dimensional Tolerances

Dimensions must be measured by a calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit must be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown on the drawings, an allowable variation of  $1/32$  inch is permissible in the overall length of component members with both ends milled. Component members without milled ends must not deviate from the dimensions shown by not more than  $1/16$  inch for members 30 feet or less in length and by more than  $1/8$  inch for members over 30 feet in length.

#### 2.2.3 Steel

Structural steel may be cut, when approved, by mechanically guided or hand-guided torches as long as an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges to be welded must be prepared in accordance with AWS D1.1/D1.1M, Subsection 3.2. Where structural steel is not to be welded, chipping or grinding will not be required, except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Hand-guided cuts, which are to be exposed or visible, must be chipped, ground, or machined to sound metal.

#### 2.2.4 Aluminum

Laying out and cutting of aluminum must be in accordance with AA ADM.

#### 2.2.5 Bolted Connections

##### 2.2.5.1 Bolted Steel Connections

Bolts, nuts, and washers must be of the type specified or indicated. Beveled washers must be used where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Bolt holes must be accurately located, smooth, perpendicular to the member, and cylindrical. Holes for bolts must be drilled or subdrilled and reamed in the shop and must not be more than  $1/16$  inch larger than the diameter of the bolt unless otherwise approved, indicated on the drawings, or specified below. Poor matching of holes will be cause for rejection. Drifting occurring during assembly must not distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

##### 2.2.5.2 Bolted Aluminum Connections

Punching, drilling, reaming, and bolting for bolted aluminum connections must conform to the requirements of AA ADM.

## 2.3 MACHINE WORK

Tolerances, allowances, and gauges for metal fits between plain, non-threaded, cylindrical parts must conform to ASME B4.1 for the class of fit shown or required, unless otherwise shown on approved detail drawings. Where fits are not shown, they must be suitable as approved. Tolerances for machine-finished surfaces designated by non-decimal dimensions must be within 1/64 inch, unless otherwise indicated on the drawings. Sufficient machining stock must be allowed to ensure true surfaces of solid material. Assembled parts must be accurately machined and all like parts must be interchangeable. All drilled holes must be accurately located.

### 2.3.1 Finished Surfaces

Surface finishes indicated or specified herein must be in accordance with ASME B46.1. Values of required roughness heights are arithmetical average deviations expressed in microinches. These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements must be determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of ASME B46.1. Values of roughness width and waviness height must be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified, the finish selected must be the most suitable for that particular surface. Provide the class of fit required and indicate it on the detail drawings with a symbol which conforms to ASME B46.1 when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks, or checks, which will make the part unsuitable for the intended use, will be cause for rejection.

### 2.3.2 Unfinished Surfaces

All work must be laid out to secure proper matching of adjoining unfinished surfaces, unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces, it must be chipped and ground smooth or machined to secure proper alignment. Unfinished surfaces must be true to the lines and dimensions shown and must be chipped or ground free of all projections and rough spots. Depressions or holes not affecting the strength or usefulness of the parts must be filled in an approved manner.

## 2.4 WELDING

Submit the Welding Procedure Specification (WPS).

### 2.4.1 Welding of Structural Steel

Welding must be in accordance with AWS D1.1/D1.1M. Welding procedures which are considered prequalified as specified in AWS D1.1/D1.1M will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification must be required for these joints.

### 2.4.2 Welding of Aluminum

Welding of aluminum must conform to AA ADM or AWS D1.2/D1.2M, Sections 1 through 7, 9 and 10. The welding process and welding operators must be prequalified as required by AWS D1.2/D1.2M, Section 5 or AA ADM, in accordance with the methods described in ASME BPVC SEC IX, Section IX.

Submit a certified report giving the results of the aluminum welding qualification tests. Also, submit a complete schedule of the welding process for each aluminum fabrication to be welded prior to commencing fabrication.

#### 2.4.3 Welding Inspection

Maintain an approved inspection system and perform required inspections in accordance with Contract Clause CONTRACTOR INSPECTION SYSTEM. Welding must be subject to inspection to determine conformance with the requirements of AWS D1.1/D1.1M, the approved welding procedures, and provisions stated in other sections of these specifications.

##### 2.4.3.1 Visual Examination

All completed welds must be cleaned and carefully examined for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity, or reinforcement and other surface defects to ensure compliance with the requirements of AWS D1.1/D1.1M, Section 3 and Section 9, Part D.

#### 2.4.4 Steel Welding Repairs

Defective welds must be repaired in accordance with AWS D1.1/D1.1M, Section 5. Defective weld metal must be removed to sound metal by use of air carbon-arc or oxygen gouging. The surfaces must be thoroughly cleaned before welding. Welds that have been repaired must be retested by the same methods used in the original inspection. Costs for repairs and retesting must be borne by the Contractor. Submit repair procedure prior to doing repair.

### 2.5 MISCELLANEOUS PROVISIONS

#### 2.5.1 Metallic Coatings

Zinc Coatings. Zinc coatings must be applied in a manner and of a thickness and quality conforming to ASTM A123/A123M. Where zinc coatings are destroyed by cutting, welding, or other causes, the affected areas must be regalvanized. Coatings 2 ounces or heavier must be regalvanized with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating.

#### 2.5.2 Cleaning of Stainless Steel

Oil, paint, and other foreign substances must be removed from stainless steel surfaces after fabrication. Cleaning must be done by vapor degreasing or by the use of cleaners of the alkaline, emulsion, or solvent type.

### 2.6 SHOP TESTING

#### 2.6.1 Wheel Assembly Testing

The first wheel assembly must be tested for correct fit and operation in the presence of the Contracting Officer, unless otherwise waived in writing. The wheel must rotate concentrically and smoothly on the bearings. The cam adjuster must provide at least 1/8 inch of adjustment in each vertical direction. Waiving of tests will not relieve the Contractor of responsibility for any fault in operation, workmanship, or material that

occurs before the completion of the contract or guarantee.

### 2.6.2 Assembly Tests

Each rolling cover, including the shell, carrier, frame, and temporary brackets, must be assembled in the shop to determine the correctness of the fabrication and matching of the component parts. Tolerances must not exceed those shown on the drawings. Each cover assembly must be closely checked to ensure that all necessary clearances have been provided and that binding does not occur in any moving part. Assembly in the shop must be done on a straight and level floor or platform; the frame must be mounted on temporary supports in a level position. The carrier must move smoothly and with minimal effort. Misalignment, poor operation, or defects disclosed must be immediately remedied by the Contractor without cost to the Government. Assembly, testing, and disassembly work must be performed in the presence of the Contracting Officer, unless waived in writing. Provide ten working days notice, in writing, of the first and each proceeding rolling cover assembly to the Contracting Officer.

## 2.7 PREPARATION FOR SHIPPING

Before disassembly for shipment, each rolling cover subassembly must be match-mark stamped (or as otherwise approved) to facilitate correct reassembly in the field. The location of stampings must be indicated by circling with a ring of white chalk after the shop finish has been applied or as otherwise directed. Each subassembly must be wood crated, slatted, skid mounted, or otherwise packaged such that abrasion does not occur during shipment.

## PART 3 EXECUTION

### 3.1 ASSEMBLY

All parts to be assembled must be thoroughly cleaned. Packing compounds, rust, dirt, grit, and other foreign matter must be removed. Holes and grooves for lubrication must be cleaned. Enclosed chambers or passages must be examined to make sure that they are free from damaging materials. Where units or items are shipped as assemblies, they will be inspected prior to installation. Pipe wrenches, cold chisels, or other tools likely to cause damage to the surfaces of rods, nuts, or other parts must not be used for assembling and tightening parts. Bolts and screws must be tightened firmly and uniformly but care must be taken not to overstress the threads. When a half nut is used for locking a full nut, the half nut must be placed first and followed by the full nut. Threads of all bolts, nuts, and screws must be lubricated with a lubricant before assembly. Threads of corrosion-resisting steel bolts and nuts must be coated with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.

### 3.2 PROTECTION OF FINISHED WORK

#### 3.2.1 Lubrication After Assembly

After assembly, all wheels must be pressure lubricated or oiled.

#### 3.2.2 Aluminum

Aluminum in contact with structural steel in the area of the cover shell fastener angle clips must be protected against galvanic or corrosive action

by being given a coat of zinc-chromate primer and a coat of aluminum paint.

### 3.3 ACCEPTANCE TESTING

The rolling cover must be field tested to ensure proper wheel adjustments to eliminate binding and track misalignment. In addition, demonstrate to the Contracting Officer that the cover and cover tracks are level. The rolling cover must be rolled the full distance of the tracks. The test must be repeated a sufficient number of times (minimum of three) to demonstrate proper operation. Misalignment, poor operation, or defects disclosed must be immediately remedied without cost to the Government. Provide all personnel necessary to conduct the tests. Testing must be performed in the presence of Contracting Officer. Notify the Contracting Officer, in writing, at least 7 days prior to testing operations.

-- End of Section --

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## SECTION 05 72 00

## DECORATIVE METAL SPECIALTIES

05/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASM-35 (2000) Specifications for Aluminum Sheet Metal Work in Building Construction, Construction Manual Series Section 5
- AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes
- AA PK-1 (2015) Pink Sheets: Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings & Ingot

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
- ASME B18.2.2 (2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
- ASME B18.6.1 (2016) Wood Screws (Inch Series)
- ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)
- ASME B18.13 (2017; ERTA 2018) Screw and Washer Assemblies - Sems (Inch Series)
- ASME B18.21.1 (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
- ASME B18.24 (2020) Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

## AMERICAN WELDING SOCIETY (AWS)

- AWS A5.3/A5.3M (1999; R 2007) Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding

AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum
ASTM INTERNATIONAL (ASTM)	
ASTM A27/A27M	(2020) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211/B211M	(2019) Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B247	(2020) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B316/B316M	(2020) Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods
ASTM C514	(2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM D1730	(2009; R 2020) Standard Practices for

## Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

- ASTM D1752** (2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
- ASTM G71** (1981; R 2014) Standard Guide for Conducting and Evaluating Galvanic Corrosion Tests in Electrolytes
- ASTM G82** (1998; R 2021; E 2021) Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- CS 23.00/AWS C2.23M/NACE #12** (2003) Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel
- SSPC PA 1** (2016) Shop, Field, and Maintenance Coating of Metals
- SSPC PS 11.01** (1982; E 2004) Black (or Dark Red) Coal Tar Epoxy Polyamide Painting System

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Existing Conditions; G[, [\_\_\_\_]]

## SD-02 Shop Drawings

Ornamental Metal Items; G[, [\_\_\_\_]]

Installation Drawings; G[, [\_\_\_\_]]

Shop and Field Connections; G[, [\_\_\_\_]]

Construction Details; G[, [\_\_\_\_]]

## SD-03 Product Data

Materials; G[, [\_\_\_\_]]

Ornamental Metal Items; G[, [\_\_\_\_]]

Aluminum-Alloy Extrusions

Aluminum-Alloy Sheets And Plates

Aluminum-Alloy Castings

Aluminum-Alloy Forgings

#### SD-04 Samples

Manufacturer's Standard Color Charts; G[, [\_\_\_\_]]

Shop Paint; G[, [\_\_\_\_]]

Finish Paint; G[, [\_\_\_\_]]

Aluminum Finishes; G[, [\_\_\_\_]]

Anchorage Devices and Fasteners; G[, [\_\_\_\_]]

#### SD-06 Test Reports

Welding Tests; G[, [\_\_\_\_]]

#### SD-07 Certificates

Welding Procedures

Ornamental Metal Items; G[, [\_\_\_\_]]

Welder Qualifications

#### SD-08 Manufacturer's Instructions

Cleaning Materials

Preventative Maintenance and Inspection

Maintenance Instructions

Application Methods

### 1.3 QUALITY CONTROL

#### 1.3.1 Samples

Submit samples for each type of [anchorage devices and fasteners](#).

Submit samples for [aluminum finishes](#), one for each type used in the project. Provide samples of standard size as used in construction. After approval, full-sized samples may be used in construction, provided that each sample is clearly identified and its location recorded.

#### 1.3.2 Color Charts

Submit [manufacturer's standard color charts](#) for [shop paint](#) and [finish paint](#) for approval by the Contracting Officer before work begins.

### 1.3.3 Qualifications for Welding Work

[ Section 05 14 00.13 WELDING STRUCTURAL ALUMINUM FRAMING applies to work specified in this section.

] [Submit [welding procedures](#) and [welding tests](#) in accordance with [AWS D1.2/D1.2M](#). Prepare all test specimens in the presence of the Contracting Officer and have specimens tested by an approved testing laboratory at the Contractor's expense.

] [Submit certification of [welder qualifications](#) by tests in accordance with [AWS D1.2/D1.2M](#). In addition, perform test on trail pieces in positions and with clearances equivalent to those actually encountered during construction. If a test weld fails to meet the requirements, complete an immediate retest of two test welds. Failure in either of the two immediate retests mandates that the welder be retested after further practice or training, and provide a complete new set of tests welds.

### ]1.3.4 Field Measurements

Records of existing conditions may be provided by the Contracting Officer before the start of work. Submit survey data showing [existing conditions](#) before preparation of shop drawings and fabrication.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Store all architectural metal items off the ground on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer.

Keep materials free from dirt and grease and protected from corrosion.

Store packaged materials in their original, unbroken containers in a dry area, until ready for installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Submit manufacturer's catalog data for the following items, listing all ornamental metal accessories including casting, forgings, fasteners, and anchorage devices.

#### [2.1.1 Concrete Inserts

[ Use galvanized wedge-type concrete inserts, and box-type, ferrous castings, with integral anchor loop at back of box and designed to accept bolts having special wedge-shape heads. Ensure that ferrous castings are malleable iron conforming to [ASTM A47/A47M](#), Grade 32510 or Grade 35018, [Grade 22010 or Grade 24118,] or medium-strength cast steel conforming to [ASTM A27/A27M](#), Grade U-60-30. Ensure that inserts are hot-dip galvanized after fabrication in accordance with [ASTM A153/A153M](#). Provide hot-dip galvanized carbon steel bolts with special wedge-shape heads, nuts, washers, and shims, in accordance with [ASTM A153/A153M](#).

] [Provide slotted-type concrete inserts and hot-dip galvanized, welded-construction, box-type, pressed steel plate, with slots to receive square-head bolts and to provide lateral adjustment of the bolt. Ensure that the insert body less anchorage lugs is at least of [4 1/2 inches](#) long.

Provide inserts with knockout cover. Use plate at least 1/8 inch thick conforming to ASTM A283/A283M, Grade C. Ensure that inserts are hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

] Provide concrete inserts that are nonremovable when embedded in concrete of 3000-pounds per square inch compressive strength and subjected to a 6000-pound tension load test in an axial direction. Ensure that concrete indicates no evidence of failure attributable to the anchoring device itself.

] [2.1.2 Masonry Anchorage Devices

Provide expansion shield masonry anchorage devices conforming to ASTM C514, Group, Type, and Class as follows:

- [ a. Lead expansion shields for machine screws and bolts 1/4 inch and smaller, head-out embedded-nut type, single-unit class, conforming to Group I, Type 1, Class 1.
- ] [b. Lead expansion shields for machine screws and bolts larger than 1/4 inch, head-out embedded-nut type, multiple-unit class, conforming to Group I, Type 1, Class 2.
- ] [c. Bolt anchor expansion shields for lag bolts, zinc-alloy long-shield anchors class, conforming to Group II, Type 1, Class 1.
- ] [d. Bolt anchor expansion shields for bolts, closed-end bottom bearing class, conforming to Group II, Type 2, Class 1.
- ] [e. [\_\_\_\_\_] type anchorage [\_\_\_\_\_] , conforming to [\_\_\_\_\_].

] [2.1.3 Toggle Bolts

Provide corrosion-resistant chromium-nickel steel conforming to AISI Type [303], [304], [\_\_\_\_], [or 316] toggle bolts of the class and style best suited for the work, conforming to ASTM C636/C636M, Type II.

] [2.1.4 Standard Bolts and Nuts

Provide standard bolts, regular hexagon-head, corrosion-resistant steel, coarse-thread series, conforming to, Type II.

Provide standard nuts, plain hexagon, regular-style, corrosion-resistant steel, conforming to ASME B18.2.2, Type II, Style 4.

] [2.1.5 Lag Bolts

Provide lag bolts, square-head, gimlet point or cone point, corrosion-resistant steel, conforming to ASME B18.2.1, Type I, Grade C.

] [2.1.6 Machine Screws

Provide machine screws, corrosion-resistant steel, cross-recess drive, flathead, conforming to ASME B18.6.3, Type III, Style [2C] [3C].

] [2.1.7 Wood Screws

Provide wood screws, corrosion-resistant steel, single-thread, flathead with cross-recess drive, conforming to ASME B18.6.1.

## ][2.1.8 Plain Washers

Provide plain washers, round, general-assembly, corrosion-resistant steel, conforming to [ASME B18.21.1](#), Type A, Grade I, Class B.

## ][2.1.9 Lock Washers

Provide lock washers, helical-spring, corrosion-resistant steel (nonmagnetic), conforming to [ASME B18.13](#) and [ASME B18.21.1](#).

## ][2.1.10 Welding Filler Metal

Provide aluminum-alloy welding filler metal for welding of aluminum alloys, conforming to [AWS A5.3/A5.3M](#) and as recommended by the aluminum producer for the work.

## ]2.2 FABRICATION

Submit fabrication drawings for [ornamental metal items](#).

## 2.2.1 Workmanship

Fabricate metalwork to the shape and size, with lines, angles, and curves true to form. Provide necessary rabbets, lugs, and brackets so that the work can be assembled. Conceal fasteners where practical.

Design exterior ornamental metal items to withstand expansion and contraction of the component parts at an ambient temperature of [100 degrees F](#) without causing harmful buckling, opening of joints, overstressing of fasteners, or other harmful effects.

Ensure that the welded fabrication meets requirements as specified in [AWS D1.2/D1.2M](#). Execute all welds behind finished surfaces without distortion or discoloration of the exposed side. Clean flux from welded joints and dress all exposed and contact surfaces.

Drill or punch holes for fasteners.

Mill joints to a close fit. Cope or miter the corner joints to a well-formed shape and true alignment with the adjacent item. Fabricate and form joints exposed to weather to prevent water intrusion.

Ensure that all castings are sound and free from warp or defects that impair their strength and appearance, with a smooth finish and sharp well-defined vertical and horizontal lines on all exposed surfaces.

[2.2.2 [Aluminum-Alloy Extrusions](#)

Provide aluminum fabrications conforming to [AA ADM](#), [AA ASM-35](#), and [AA PK-1](#).

Provide 6063, temper T5 extrusions conforming to [ASTM B221](#) [ASTM B221M](#).

Provide aluminum-alloy and tempered extrusions recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of aluminum alloy 6063, temper T5, conforming to [ASTM B221](#) [ASTM B221M](#).

][2.2.3 [Aluminum-Alloy Sheets and Plates](#)

[ Provide aluminum alloy 3003, temper H16 sheets and plates, conforming to [ASTM B209](#) unless otherwise specified.

] [Provide aluminum alloy 5005, temper H16 sheets and plates with a clear anodized coating conforming to [ASTM B209](#).

] [Provide aluminum-alloy and tempered sheets and plates recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of alloy 5005, temper H16, conforming to [ASTM B209](#).]

#### ] [2.2.4 Aluminum-Alloy Castings

[ Provide aluminum alloy 5140, temper F sand castings, conforming to [ASTM B26/B26M](#).

] [Provide aluminum-alloy castings as recommended by the Aluminum Association with a clear anodized coating.

] [Provide aluminum-alloy castings containing the casting alloy and condition recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of alloy 5140, temper F, conforming to [ASTM B26/B26M](#).

#### ] [2.2.5 Aluminum-Alloy Forgings

[ Provide aluminum-alloy 6061, temper T6 forgings, conforming to [ASTM B247](#).

] [Provide aluminum-alloy and tempered forgings recommended by the aluminum producer with the specified finish of integral-color anodized coating having mechanical properties equal to or exceeding those of aluminum alloy 6061, temper T6, conforming to [ASTM B247](#).

#### ] [2.2.6 Metals for Fasteners

Provide fastener identification conforming to [ASME B18.24](#).

Provide aluminum-alloy bolts and screws made from rod conforming to [ASTM B211/B211M](#), alloy 2024, and temper T351.

Provide aluminum-alloy nuts made from rod conforming to [ASTM B211/B211M](#), alloy 6061, and temper T6.

Provide aluminum-alloy washers made from sheet conforming to [ASTM B209](#), alloy 2024, and temper T4.

Provide aluminum-alloy rivets made from rod or wire conforming to [ASTM B316/B316M](#), alloy 6053, and temper T61.

Provide corrosion-resistant steel fasteners made of chromium-nickel steel, AISI Type [303], [304], [\_\_\_], [or 316], with form and condition best suited for the application.

#### 2.2.7 Shop Paint for Aluminum

Provide a shop paint with an inhibitive epoxy polyamide primer conforming to [SSPC PS 11.01](#), [CS 23.00/AWS C2.23M/NACE #12](#), [ASTM G71](#) and [ASTM G82](#).



### 2.2.8 Protection of Aluminum from Dissimilar Materials

Protect aluminum surfaces that will come in contact with dissimilar metals, or masonry, concrete, or wood, with epoxy polyamide conforming to [SSPC PS 11.01](#), and topcoated with aliphatic polyurethane conforming to [ASTM G71](#) and [ASTM G82](#)

Prepare aluminum surfaces to be painted by the acid pickling method conforming to [ASTM D1730](#), Type B, Method 2 or Method 3.

Apply paint to dry, clean surfaces by brush or spraying to provide a minimum dry-film thickness of 1.5 mils.

### 2.2.9 Aluminum Finishes

Provide a finish for exposed-to-view aluminum surfaces of architectural metal items conforming to [AA DAF45](#) and finished as specified for each of the following items:

- [ a. Aluminum producer's "as-fabricated mill finish," conforming to AA M10, as specified in [AA DAF45](#).
- ] [b. Frosted finish with medium-matte chemical-etch finish with a clear, nonyellowing methacrylate lacquer coating, with a finish meeting the requirements to AA C22-R1X, as specified in [AA DAF45](#), applied in two coats with interim drying, by brush, spraying, or other approved method to provide a continuous minimum dry film thickness of 0.6 mil.
- ] [c. Frosted finish Class II; clear anodized coating, medium-matte chemical-etch finish; Architectural Class II 4 to 0.7 mil thick anodized coating producing natural aluminum color finish conforming to AA C22-A31, as specified in [AA DAF45](#).
- ] [d. Frosted finish Class I, clear anodized coating, medium-matte chemical-etch finish; Architectural Class I 0.7 mil and greater thickness anodized coating producing natural aluminum color finish conforming to AA C22-A41, as specified in [AA DAF45](#).
- ] [e. Polished finish Class II, clear anodized coating, smooth specular-buffed mechanical finish; Architectural Class II 0.4 to 0.7 mil thick anodized coating producing natural aluminum color finish conforming to AA M21-A31, as specified in [AA DAF45](#).
- ] [f. Satin finish Class II; clear anodized coating, medium-satin directional textured mechanical finish and Architectural Class II 0.4 to 0.7 mil thick anodized coating producing natural aluminum color finish conforming to AA M32-A31, as specified in [AA DAF45](#).
- ] [g. Matte finish Class II; clear anodized coating, medium-matte nondirectional textured mechanical finish and Architectural Class II 0.4 to 0.7 mil thick anodized coating producing natural aluminum color finish conforming to AA M42-A31, as specified in [AA DAF45](#).
- ] [h. Polished-frosted finish Class II; clear anodized coating, smooth specularbuffed mechanical finish, followed by a medium matte chemical etch finish, Architectural Class II 0.4 to 0.7 mil thick anodized coating producing natural aluminum color finish conforming to AA M21-C22-A31, as specified in [AA DAF45](#).

- ] [i. Polished-frosted finish Class I, clear anodized coating smooth specular-buffed mechanical finish, followed by a medium-matte chemical-etch finish, Architectural Class I, 0.7 mil and greater thickness of anodized coating producing natural aluminum color finish conforming to AA M21-C22-A41, as specified in AA DAF45.
- ] [j. Polished-frosted finish integral-color anodized coating, smooth specular-buffed mechanical finish, followed by a nonetching inhibitive alkaline cleaning, medium-matte, chemical-etch finish, Architectural Class 1, 0.7 mil and greater thickness of anodized coating producing dark bronze integral-color finish conforming to AA DAF45.
- ] [k. Match the finish color and appearance to that of the aluminum finish sample approved for each architectural metal item within the aluminum producer's standard color range.

#### ] 2.2.10 Ornamental Metal Items

##### 2.2.10.1 Aluminum Joint Cover Assemblies

Design aluminum joint cover assemblies for horizontal movement and the joint width indicated.

Provide mill finish for exposed-to-view surfaces.

Provide floor joint cover assemblies consisting of a continuous frame unit on each side of floor-to-floor joints or on one side of floor-to-wall joints as required by construction conditions. Include floor cover plates, filler strips, anchors, and other accessories as required to complete the installation, and as follows:

Fabricate floor frame units from aluminum-alloy extrusions with an integral curb edge bar for the expansion joint edges. Provide integral grooves to receive anchor bolts, and floor cover plate with filler strip surfaces that will finish flush to the finished floor elevation when the floor cover assembly is installed. Provide corrosion-resistant coated aluminum alloy or steel anchor bolts and nuts, spaced not more than 3 inches from each end and not more than 18 inches on center between end anchors. Furnish coated steel anchor bolts and nuts conforming to SSPC PA 1. Provide frame splice connectors as required to complete the installation.

##### 2.2.10.1.1 Floor Cover Plates

- [ Provide plain floor cover plates, aluminum-alloy extrusions with smooth surface.
- ] [Provide recessed floor cover plates, aluminum-alloy extrusions with recess to receive resilient floor covering, with a recess depth as required to provide a resilient floor covering surface flush with the finished floor elevation.
- ] [Provide nonslip floor cover plates, aluminum-alloy castings with abrasive grit embedded uniformly into the walking surface at the time of casting, with 20-grain aluminum oxide abrasive grit.
- ] Provide floor cover plates of the patterns and widths indicated, and lengths as long as practical, with metal thickness not less than 1/4 inch. Drill and countersink fixed edge of floor cover plates to receive flathead screws, spaced not more than 3 inches from each cover plate end and not

more than 18 inches on center between the end screw holes. Provide corrosion-resistant steel screws for securing floor cover plates.

#### 2.2.10.1.2 Wall And Ceiling Joint Cover Assemblies

Provide rubber and cork composition tape filler strips with pressure-sensitive adhesive coating on one face and smooth suede surface on the exposed face, conforming to ASTM D1752, not less than 1 1/2 inches wide and a depth as required to provide a surface flush with the finished floor elevation.

Provide wall and ceiling joint cover assemblies consisting of continuous anchor strips on one side of the wall or ceiling expansion joint; wall and ceiling cover plates; and seals, anchors, and other accessories as required to complete the installation, and as follows:

- a. Provide aluminum-alloy wall and ceiling anchor strip extrusions fabricated to provide an integral curb bar edge and integral lugs to receive snap-on cover plates. Field-drill fixed edge of anchor strips with holes to receive screws, spaced not more than 3 inches from each end and not more than 12 inches on center between the end screw holes. Provide cadmium-plated screws with masonry anchorage devices or toggle bolts as required by construction conditions.
- b. Provide aluminum-alloy wall and ceiling cover plate extrusions of the patterns and widths indicated, designed for snap-on application over anchor strips, fabricated with integral grooves to receive sealing gaskets, and having a smooth exposed-to-view surface.

Provide vinyl sealing gaskets for [exterior wall joint cover assemblies] [wall and ceiling joint cover assemblies].

#### 2.2.10.1.3 Frosted Finish

[ Provide a frosted finish with Class II clear anodized coating for exposed-to-view surfaces.

] [Provide a frosted finish with lacquer coating for interior wall and ceiling joint cover assembly that are exposed-to-view surfaces.]

[ Provide a frosted finish with Class II clear anodized coating for exterior wall joint cover assembly that are exposed-to-view surfaces.

### ] PART 3 EXECUTION

#### 3.1 INSTALLATION

Submit installation drawings for ornamental metal items, shop and field connections and construction details showing location, dimensions, size, and weight or gauge as applicable of each ornamental item; type and location of shop and field connections; and other pertinent construction and erection details. Show on drawings location and details of anchorage devices embedded in cast-in-place concrete and masonry construction.

##### 3.1.1 Anchorage Devices Embedded In Other Construction

Install decorative metal work in accordance with the approved shop drawings and descriptive data for each ornamental metal item, as specified.

Securely fasten decorative metal items plumb and true to horizontal and vertical lines and levels.

### 3.1.2 Holes for Other Work

Provide holes where indicated for securing other work to metal work.

### 3.1.3 Fastening to Construction-In-Place

Provide anchorage devices and fasteners where necessary for fastening ornamental metal items to construction-in-place. Include threaded fasteners for concrete inserts embedded in cast-in-place concrete; masonry anchorage devices and threaded fasteners for solid masonry and concrete-in-place; toggle bolts for hollow masonry and stud partitions; through-bolting for masonry and wood construction; lag bolts and wood screws for wood construction; and threaded fasteners for structural steel. Provide fastening as indicated and as specified. Do not fasten to wood plugs in masonry or concrete-in-place.

### 3.1.4 Cutting and Fitting

Perform required cutting, drilling, and fitting for the installation of ornamental metal work. Execute cutting, drilling, and fitting carefully; when required; fit in-place work before fastening.

### 3.1.5 Setting Masonry Anchorage Devices

Set all masonry anchorage devices in masonry or concrete-in-place construction in accordance with the anchorage device manufacturer's printed instructions. Drill anchorage holes to the depth, diameter, and size recommended by the manufacturer of the particular anchorage device used. Leave drilled anchorage holes rough, not reamed, and free of drill dust.

### 3.1.6 Threaded Connections

Countersink flat bolts and screw heads where anchors are exposed to view, and tightly secure threaded connections so that the threads are entirely concealed by fitting, unless otherwise specified.

## 3.2 FIELD QUALITY CONTROL

### 3.2.1 Finished Ornamental Metal Work Requirements

Ornamental metal work will be rejected for any of the following deficiencies:

- a. Finish of exposed-to-view aluminum surfaces having color or appearance that is outside the color or appearance range of the approved samples for aluminum finish.
- b. Installed ornamental metal items having stained, discolored, abraded, or otherwise damaged exposed-to-view aluminum surfaces that cannot be removed by cleaning or repairing.
- c. Installed ornamental metal items that do not match the approved sample.
- d. Aluminum surfaces in contact with dissimilar materials that are not protected as specified.

### 3.3 ADJUSTING AND CLEANING

Before final acceptance, wash exposed-to-view aluminum surfaces with clean water and soap and rinse with clean water. Do not use acid solutions, steel wool, or other harsh abrasives. Remove stains that remain after cleaning or restore the finish in accordance with the aluminum producer's recommendations

Perform all [preventative maintenance and inspection](#) in accordance with the aluminum producer's recommended [cleaning materials](#) and [application methods](#) including precautions in the use of cleaning materials that maybe detrimental to the aluminum finish when improperly applied.

### 3.4 MAINTENANCE INSTRUCTIONS

Submit the aluminum producer's recommended [maintenance instructions](#) for cleaning materials and application.

-- End of Section --

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## SECTION 06 10 00

ROUGH CARPENTRY  
08/16, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## AMERICAN HARDBOARD ASSOCIATION (AHA)

**AHA A135.4** (1995; R 2004) Basic Hardboard

## AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

**AITC 111** (2005) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection

**AITC TCM** (2012) Timber Construction Manual, 5th Edition

**ANSI/AITC A190.1** (2007) American National Standard, Structural Glued Laminated Timber

## AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

**ALSC PS 20** (2015) American Softwood Lumber Standard

## AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

**AREMA Eng Man** (2017) Manual for Railway Engineering

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

**ASME B18.2.1** (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

**ASME B18.2.2** (2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

**ASME B18.5.2.1M** (2006; R 2011) Metric Round Head Short Square Neck Bolts

**ASME B18.5.2.2M** (1982; R 2010) Metric Round Head Square Neck Bolts

ASME B18.6.1	(2016) Wood Screws (Inch Series)
AMERICAN WOOD COUNCIL (AWC)	
AWC NDS	(2015) National Design Specification (NDS) for Wood Construction
AWC WFCM	(2012) Wood Frame Construction Manual for One- and Two-Family Dwellings
AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)	
AWPA BOOK	(2015) AWPA Book of Standards
AWPA M2	(2019) Standard for the Inspection of Preservative Treated Wood Products for Industrial Use
AWPA M6	(2013) Brands Used on Preservative Treated Materials
AWPA P5	(2015) Standard for Waterborne Preservatives
AWPA P18	(2014) Nonpressure Preservatives
AWPA P49	(2015; R 2021) Standard for Fire Retardant FR-1
AWPA T1	(2022) Use Category System: Processing and Treatment Standard
AWPA U1	(2022) Use Category System: User Specification for Treated Wood
APA - THE ENGINEERED WOOD ASSOCIATION (APA)	
APA E30	(2016) Engineered Wood Construction Guide
APA E445	(2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
APA EWS R540	(2013) Builder Tips: Proper Storage and Handling of Glulam Beams
APA EWS T300	(2007) Technical Note: Glulam Connection Details
APA F405	(19) Product Guide: Performance Rated Panels
APA L870	(2010) Voluntary Product Standard, PS 1-09, Structural Plywood
APA S350	(2014) PS 2-10, Performance Standard for Wood-Based Structural-Use Panels

ASTM INTERNATIONAL (ASTM)



ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C1136	(2021) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1396/C1396M	(2017) Standard Specification for Gypsum Board
ASTM D198	(2015) Standard Test Methods of Static Tests of Lumber in Structural Sizes
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D1435	(2013) Standard Practice for Outdoor Weathering of Plastics
ASTM D1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D2344/D2344M	(2016) Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D2898	(2010; R 2017) Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D3498	(2019a) Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing
ASTM D6108	(2013) Standard Test Method for Compressive Properties of Plastic Lumber and Shapes
ASTM D6109	(2013) Standard Test Methods for Flexural

Properties of Unreinforced and Reinforced  
Plastic Lumber and Related Products

ASTM D6111	(2013a) Standard Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement
ASTM D6112	(2013) Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes
ASTM D6117	(2016) Standard Test Methods for Mechanical Fasteners in Plastic Lumber and Shapes
ASTM E96/E96M	(2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM F547	(2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials
ASTM F1667/F1667M	(2021a) Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120	(2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products
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CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1	(2016) Particleboard
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CSA GROUP (CSA)

CSA Z809-08	(R2013) Sustainable Forest Management
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FM GLOBAL (FM)

FM 4435	(2013) Roof Perimeter Flashing
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FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship
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GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use
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INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)
NHLA Rules	(2015) Rules for the Measurement & Inspection of Hardwood & Cypress NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)
NELMA Grading Rules	(2013) Standard Grading Rules for Northeastern Lumber PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)
PEFC ST 2002:2013	(2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)
RIS Grade Use	(1998) Redwood Lumber Grades and Uses SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)
SCMA Spec	(1986; Supple. No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress SOUTHERN PINE INSPECTION BUREAU (SPIB)
SPIB 1003	(2014) Standard Grading Rules for Southern Pine Lumber SUSTAINABLE FOREST INITIATIVE (SFI)
SFI 2015-2019	(2015) Standards, Rules for Label Use, Procedures and Guidance TRUSS PLATE INSTITUTE (TPI)
TPI 1	(2014) National Design Standard for Metal Plate Connected Wood Truss Construction, Including Commentary and Appendices
TPI HIB	(1991) Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses U.S. DEPARTMENT OF COMMERCE (DOC)
DOC/NIST PS56	(1973) Structural Glued Laminated Timber
DOC/NIST PS58	(1973) Basic Hardboard (ANSI A135.4)

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923	(Rev A; Notice 3) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 3) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)
CID A-A-1925	(Rev A; Notice 3) Shield Expansion (Nail Anchors)
FS UU-B-790	(Rev A; Notice 2) Building Paper Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770	Formaldehyde Standards for Composite Wood Products
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## UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
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## WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2015) Standard Grading Rules
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## WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(2017) Western Lumber Grading Rules
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

[	Structural Glued Laminated Members; G[, [____]]
][	Trussed Rafters; G[, [____]]
][	Trussed Joists; G[, [____]]
][	Fabricated Structural Members; G[, [____]]
]	Modifications of Structural Members; G[, [____]]

Drawings of structural laminated members, fabricated wood trusses,

engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

[ Nailers and [Nailing Strips](#); G[, [\_\_\_\_\_]]

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

] SD-03 Product Data

[ [Salvaged Lumber](#)

] [[Recovered Lumber](#)

] [[Underlayment](#)

] [Plastic Lumber](#)

[Fiberboard Wall Sheathing](#)

[Cellulose Honeycomb Panels](#)

[Fire-retardant Treatment](#)

[Structural-use and OSB Panels](#)

[Oriented Strand Board](#)

[Adhesives](#)

[ [Biobased Content for Strawboard Panels](#); S

] [[Biobased Content for Cork Underlayment](#); S

] [[Recycled Content for Plastic Lumber](#); S

] [[Recycled Content for Fiberboard Underlayment](#); S

] [[Recycled Content for Cork Underlayment](#); S

] [[Recycled Content for Fiberboard Wall Sheathing](#); S

] [[Recycled Content for Cellulose Honeycomb Panels](#); S

] SD-05 Design Data

[Modifications of Structural Members](#); G[, [\_\_\_\_\_]]

Design analysis and calculations showing design criteria used to accomplish the applicable analysis.

SD-06 Test Reports

[Preservative-treated Lumber and Plywood](#)

SD-07 Certificates

- [ Certificates of Grade
- ][ Certified Sustainably Harvested Virgin Lumber; S
- ][ Certified Sustainably Harvested Natural-decay and Insect-resistant Wood; S
- ][ Certified Sustainably Harvested Framing Lumber; S
- ][ Certified Sustainably Harvested Structural Glued Laminated Timber; S
- ][ Certified Sustainably Harvested Plywood Subflooring; S
- ][ Certified Sustainably Harvested Structural-use and OSB Panel Subfloor Sheathing; S
- ][ Certified Sustainably Harvested Plywood Combination Subfloor Underlayment; S
- ][ Certified Sustainably Harvested Plywood Wall Sheathing; S
- ][ Certified Sustainably Harvested Structural-use and OSB Panel Wall Sheathing; S
- ][ Certified Sustainably Harvested Plywood Roof Sheathing; S
- ][ Certified Sustainably Harvested Plywood Diaphragm; S
- ][ Certified Sustainably Harvested Structural-use and OSB Panel Diaphragm; S
- ][ Certified Sustainably Harvested Plywood Shear Wall; S
- ][ Certified Sustainably Harvested Structural-use and OSB Panel Shear Wall; S
- ][ Certified Sustainably Harvested Plywood for Other Uses; S
- ][ Certified Sustainably Harvested Structural-use and OSB Panels for Other Uses; S
- ][ Certified Sustainably Harvested Plywood Underlayment; S
- ] Preservative Treatment
- [ Indoor Air Quality for Particleboard Underlayment; S
- ][ Indoor Air Quality for Fiberboard Underlayment; S
- ][ Indoor Air Quality for Strawboard Panels; S
- ][ Indoor Air Quality for Fiberboard Wall Sheathing; S
- ][ Indoor Air Quality for Aerosol Adhesives; S
- ][ Indoor Air Quality for Non-aerosol Adhesives; S

## ] SD-10 Operation and Maintenance Data

## Plastic

When not labeled, identify types in Operation and Maintenance Manual.

## Take-back Program

Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling or reuse.

## 1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Store wood I-beams and glue-laminated beams and joists on edge. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. [ Handle and store laminated timber in accordance with [AITC 111](#) or [APA EWS R540](#). ] Do not use materials that have visible moisture or biological growth. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

## 1.4 GRADING AND MARKING

## 1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency must be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view must not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

## 1.4.2 Structural Glued Laminated Timber

Mark each member with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of structural glued laminated timber products. The marking must indicate compliance with [ANSI/AITC A190.1](#) and must include all identification information required by [ANSI/AITC A190.1](#). [ Structurally end-jointed lumber must also be certified and grade marked in accordance with [ANSI/AITC A190.1](#). ]

## 1.4.3 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark must identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with [APA L870](#). Surfaces that are to be exposed to view must not bear grademarks

or other types of identifying marks.

#### 1.4.4 Structural-Use and OSB Panels

Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel. The mark must indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), [APA F405](#).

#### 1.4.5 Preservative-Treated Lumber and Plywood

The Contractor is responsible for the quality of treated wood products. Each treated piece must be inspected in accordance with [AWPA M2](#) and permanently marked or branded, by the producer, in accordance with [AWPA M6](#). The Contractor must provide Contracting Officer's Representative (COR) with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

#### 1.4.6 Fire-Retardant Treated Lumber

Mark each piece in accordance with [AWPA M6](#), except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber must be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of [AWPA M6](#).

#### 1.4.7 Hardboard, Gypsum Board, and Fiberboard

Mark each sheet or bundle to identify the standard under which the material is produced and the producer.

#### 1.4.8 Plastic Lumber

Label plastic products to be incorporated into the project in accordance with [ASTM D1972](#), or provide product data indicating polymeric information in the Operation and Maintenance Manual.

- a. Type 1: Polyethylene Terephthalate (PET, PETE).
- b. Type 2: High Density Polyethylene (HDPE).
- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
- d. Type 4: Low Density Polyethylene (LDPE).
- e. Type 5: Polypropylene (PP).
- f. Type 6: Polystyrene (PS).
- g. Type 7: Other. Use of this code indicates that the package in question. is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

#### 1.5 SIZES AND SURFACING

[ALSC PS 20](#) for dressed sizes of yard and structural lumber. Lumber must be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes must be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.



## 1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products must be as follows at the time of delivery to the job site:

- a. Framing lumber and board, 19 percent maximum
- b. Timbers 5 inches and thicker, 25 percent maximum
- [ c. Roof planking, 15 percent maximum
- ] d. Materials other than lumber; moisture content must be in accordance with standard under which the product is produced

## 1.7 PRESERVATIVE TREATMENT

Treat wood products with waterborne wood preservatives conforming to AWPA P5. Pressure treatment of wood products must conform to the requirements of AWPA BOOK Use Category System Standards U1 and T1. Pressure-treated wood products must not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products must not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP), and must not be classified as hazardous waste. Submit certification from treating plant stating chemicals and process used and net amount of preservatives retained are in conformance with specified standards. In accordance with AWPA U1 provide non-copper preservative treatment such as EL2, PTI or SBX, DOT for products in direct contact with sheet metal.

- a. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use. 0.60 pcf intended for Ammoniacal Copper Quaternary Compound (ACQ)-treated foundations. 0.80 to 1.00 pcf intended for ACQ-treated pilings. All wood must be air or kiln dried after treatment. Specific treatments must be verified by the report of an approved independent inspection agency, or the AWPA Quality Mark on each piece. [ Do not incise surfaces of lumber that will be exposed.] Minimize cutting and avoid breathing sawdust. Brush coat areas that are cut or drilled after treatment with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution. [ All lumber and woodwork must be preservative treated.] Plastic lumber must not be preservative treated. The following items must be preservative treated:
  - (1) Wood framing, woodwork, and plywood up to and including the subflooring at the first-floor level of structures having crawl spaces when the bottoms of such items are 24 inches or less from the earth underneath.
  - (2) Wood members that are in contact with water.
  - (3) Exterior wood steps, platforms, and railings; and all wood framing of open, roofed structures.
  - (4) Wood sills, soles, plates, furring, and sleepers that are less than 24 inches from the ground, furring and nailers that are set into

or in contact with concrete or masonry.

(5) Nailers, edge strips, crickets, curbs, and cants for roof decks.

#### 1.7.1 Existing Structures

Use borate, permathrin, or a sodium silicate wood mineralization process to treat wood. Use borate for interior applications only.

#### 1.7.2 New Construction

Use a boron-based preservative conforming to [AWPA P18](#), sodium silicate wood mineralization process, or Ammoniacal Copper Quaternary Compound to treat wood. Use boron-based preservatives for above-ground applications only.

### 1.8 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated with fire retardants conforming to [AWPA P49](#). Fire retardant treatment of wood products must conform to the requirements of [AWPA U1](#), Commodity Specification H and [AWPA T1](#), Section H. Treatment and performance inspection must be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting must be subjected to an accelerated weathering technique in accordance with [ASTM D2898](#) prior to being tested. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, must receive exterior fire-retardant treatment. [Fire-retardant-treated wood products must be free of halogens, sulfates, ammonium phosphate, and formaldehyde. ]Items to be treated include the following:

a. [\_\_\_\_\_].

### 1.9 QUALITY ASSURANCE

#### 1.9.1 Drawing Requirements

For [fabricated structural members](#), trusses, glulam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

#### 1.9.2 Data Required

Submit calculations and drawings for all proposed [modifications of structural members](#). Do not proceed with modifications until the submittal has been approved.

#### 1.9.3 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

#### 1.9.4 Plastic Lumber Performance

Plastic lumber intended for use in exterior applications must have no

fading or discoloration and no change in dimensional stability as tested in accordance with [ASTM D1435](#) for a period of [1] [3] [5] [\_\_\_\_\_] year[s].

#### 1.10 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

#### 1.11 CERTIFICATIONS

##### [1.11.1 Certified Wood Grades

Provide [certificates of grade](#) from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

##### ]1.11.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by [FSC STD 01 001](#) [, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019](#), or other third party program certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

##### ]1.11.3 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

##### [1.11.3.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

]

##### [1.11.3.2 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), strawboard, panel substrates, and door cores. Provide products certified to meet requirements of both [40 CFR 770](#) and [CARB 93120](#). Provide current product certification documentation from certification body.

#### ]PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible. [ Provide [certified sustainably harvested virgin lumber](#).]

### [2.1.2 Salvaged Lumber

Provide salvaged lumber where specified. Unless otherwise noted, salvaged lumber must be delivered clean, denailed, and free of paint, finish materials, and other contamination. Lumber must meet the other criteria within this section. Provide documentation certifying products are from salvaged lumber sources.

### ] [2.1.3 Recovered Lumber

Use recovered lumber where practical. Unless otherwise noted, recovered lumber must be delivered clean and free of contamination. Provide grading certificates for any recovered wood materials used in structural applications. Lumber must meet the other criteria within this section. Provide documentation certifying products are from recovered lumber sources.

### ] 2.1.4 Natural Decay- and Insect-Resistant Wood

[Naturally durable wood must be [certified sustainably harvested natural-decay and insect-resistant wood](#). ]An occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which the sapwood occurs is heartwood. [ The primary species to use on this project is [redwood], [\_\_\_\_\_].]

### [2.1.5 Plastic Lumber

HDPE lumber must contain a minimum of 90 percent total recycled content. Mixed plastics and cellulose lumber must contain a minimum of 100 percent total recovered materials content, with a minimum of 50 percent post-consumer recycled content. HDPE/fiberglass lumber must contain a minimum of 95 percent total recovered materials content with a minimum of 75 percent post-consumer recycled content. Other mixed resin lumber must contain a minimum of 95 percent total recovered materials content with a minimum of 50 percent post-consumer recycled content. Provide data identifying percentage of [recycled content for plastic lumber](#).

#### 2.1.5.1 Shear Parallel to Length

Maximum 1,000 psi in accordance with [ASTM D2344/D2344M](#).

#### 2.1.5.2 Density

[ASTM D6111](#).

#### 2.1.5.3 Compressive Strength

- a. Secant Modulus: Minimum 70,000 psi in accordance with [ASTM D6108](#).
- b. Stress at 3 percent strain: Minimum 1,500 psi in accordance with [ASTM D6108](#).
- c. Compression Parallel to Grain: Minimum 3,000 psi in accordance with [ASTM D6112](#).
- d. Compression Perpendicular to Grain: Minimum 1,000 psi in accordance with [ASTM D6112](#).

#### 2.1.5.4 Flexural Strength

Minimum 2,000 psi in accordance with ASTM D6109.

#### 2.1.5.5 Tensile Strength

Minimum 1,250 psi in accordance with ASTM D198.

#### 2.1.5.6 Coefficient of Thermal Expansion

Maximum 0.000080 in/in/degree F in accordance with ASTM D696.

#### 2.1.5.7 Screw Withdrawal

350 lbs in accordance with ASTM D6117.

#### 2.1.5.8 Nail Withdrawal

150 lbs in accordance with ASTM D6117.

### ]2.2 LUMBER

#### 2.2.1 Structural Lumber

[Except where a specific grade is indicated or specified,] Any of the species and grades listed in AWC NDS that have allowable unit stresses in pounds per square inch (psi) not less than [[\_\_\_\_\_] Fb, [\_\_\_\_\_] Ft, [\_\_\_\_\_] Fc, with [\_\_\_\_\_] E] [allowable unit stresses indicated]. Use for joists, rafters, headers, trusses, beams (except collar beams), columns, posts, stair stringers, girders, and all other members indicated to be stress rated. [ Structural lumber exposed to view in [\_\_\_\_\_] must be appearance grade [of [\_\_\_\_\_] species] [of any species] meeting the allowable unit stresses [specified] [indicated].] Design of members and fastenings must conform to AITC TCM. Other stress graded or dimensioned items such as blocking, carriages, and studs must be standard or No. 2 grade except that studs may be Stud grade.

#### 2.2.2 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing must be one of the species listed in the table below. Minimum grade of species must be as listed. [Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of DOC/NIST PS56.] [ Provide certified sustainably harvested framing lumber.]

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White Pine and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.2.3 Structural Glued Laminated Timber

ANSI/AITC A190.1, allowable working stress values for loads of normal duration in pounds per square inch (psi) not less than the following:

- Bending Members, [ ] Fb, [ ] Fv, [ ] E.
- Compression Members, [ ] Fc, [ ] E.
- Tension Members, [ ] Ft, [ ] E.

Fabricated with wet-use adhesives. Beams must use [ glue-laminated] [ and] [laminated-strand] [laminated-veneer] lumber. Posts and studs must use laminated-strand lumber. Joists must use laminated-veneer lumber. Members must be [Industrial] [Architectural] [Premium] Appearance Grade, sealed with a penetrating sealer, and [individually wrapped] [bundle wrapped] as standard with the manufacturer and approved. Members must be complete with hardware for joining laminated members and for their connection to other construction. [ Provide certified sustainably harvested structural glued laminated timber.] [ When located on the interior of buildings, provide products with no added urea-formaldehyde resins.]

2.3 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

APA L870, APA S350, APA E445, and APA F405 respectively.

2.3.1 Subflooring

2.3.1.1 Plywood

C-D Grade, Exposure 1 durability classification, Span rating of [24/16] [48/24] or greater. [ Provide certified sustainably harvested plywood subflooring.]

2.3.1.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [32/16] [48/24] or greater. OSB, APA E445, Rated Sturd-I-Floor. [ Provide certified sustainably harvested structural-use and OSB panel subfloor sheathing.]

2.3.2 Combination Subfloor-Underlayment

2.3.2.1 Plywood

[Underlayment Grade, Exposure 1] [ , or ] [Exterior Type, C-C (Plugged)



Grade].[ Provide [certified sustainably harvested plywood combination subfloor underlayment](#).] Minimum thickness must be as listed below [except where indicated to have greater thickness].

<u>Support Spacing</u>	<u>Underlayment Minimum Thickness</u>
16 inches	1/2 inch for Group 1 species
	19/32 inch for Group 2 and 3 species
	23/32 inch for Group 4 species
24 inches	23/32 inch for Group 1 species
	7/8 inch for Group 2 and 3 species
	1 inch for Group 4 species

2.3.2.2 Structural-Use Panel

Combination subfloor-underlayment grade with durability equivalent to [Interior plywood with Exterior glue (Exposure 1)] [Exterior plywood], Span Rating of [16] [20] [24 ] [48] or greater.

2.3.3 Wall Sheathing

2.3.3.1 Plywood

C-D Grade, Exposure 1, and a minimum thickness of [3/8] [1/2] inch[ , except where indicated to have greater thickness]. [ Provide [certified sustainably harvested plywood wall sheathing](#).] [ Provide exterior grade material with phenol resin for interior and exterior applications.]

2.3.3.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [16/0] [24/0] or greater. OSB, APA Rated Sheathing. OSB must be a phenolic-glued board. [ Provide [certified sustainably harvested structural-use and OSB panel wall sheathing](#).]

2.3.4 Roof Sheathing

2.3.4.1 Plywood

C-D Grade, Exposure 1, with an Identification Index of not less than [24/0] [\_\_\_\_\_]. [ Provide [certified sustainably harvested plywood roof sheathing](#).] Provide exterior grade material with phenol resin for all applications.

2.3.4.2 Structural-Use Panel

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [24/0] [\_\_\_\_\_] or greater.

2.3.5 Diaphragms

#### 2.3.5.1 Plywood

[Structural I] [Structural II], [C-C] [C-D] grade, Exposure 1, and a minimum thickness of [\_\_\_\_\_] inch. [ Provide [certified sustainably harvested plywood diaphragm.](#)]

#### 2.3.5.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1 and a minimum thickness of [\_\_\_\_\_] inch. [ Provide [certified sustainably harvested structural-use and OSB panel diaphragm.](#)]

#### 2.3.6 Shear Walls

##### 2.3.6.1 Plywood

[Structural I] [Structural II], [C-C] [C-D] [\_\_\_\_\_] Grade and a minimum thickness of [\_\_\_\_\_] inch. [ Provide [certified sustainably harvested plywood shear wall.](#)]

##### 2.3.6.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Interior plywood with Exterior glue (Exposure 1) and a minimum thickness of [\_\_\_\_\_] inch. [ Provide [certified sustainably harvested structural-use and OSB panel shear wall.](#)]

#### 2.3.7 Other Uses

##### 2.3.7.1 Plywood

Plywood for [\_\_\_\_\_] . C-D Grade, Exposure 1. [ Provide [certified sustainably harvested plywood for other uses.](#)]

##### 2.3.7.2 Structural-Use and OSB Panels

Structural-use and OSB panels for [\_\_\_\_\_] . Sheathing grade with durability equivalent to Exposure 1 and a minimum thickness of [\_\_\_\_\_] inch. [ Provide [certified sustainably harvested structural-use and OSB panels for other uses.](#)]

#### 2.4 UNDERLAYMENT

Underlayment must conform to one of the following:

##### 2.4.1 Hardboard

[AHA A135.4](#) service class, sanded one side, 1/4 inch thick, 4 feet wide.

##### [2.4.2 Particleboard

[CPA A208.1](#), Grade 1-M-1, 1/4 inch thick, 4 by 4 feet. Compressed [[straw](#)] fibers with [[phenol formaldehyde](#)] [[polymeric methylene diisocyanate \(PMDI\)](#)] resin binder. [ Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for particleboard underlayment.](#)]

##### ]2.4.3 Plywood

Plywood must conform to [APA L870](#), underlayment grade with exterior glue, or C-C (Plugged) exterior grade 11/32 inch thick, 4 feet wide. [ Provide [certified sustainably harvested plywood underlayment.](#)]

#### 2.4.4 Oriented Strand Board

OSB underlayment grade [0.225 inch](#).

#### 2.4.5 Fiberboard

Use [structural fiberboard, minimum 80 percent recycled newspaper.] [gypsum fiberboard, minimum 15 percent post-consumer newspaper.] [ Provide data identifying percentage of [recycled content for fiberboard underlayment.](#)] [agrifiber particleboard.] [particleboard or MDF.] [ Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for fiberboard underlayment.](#)]

#### [2.4.6 Strawboard Panels

Minimum 70 percent agricultural waste straw with no added formaldehyde binders. Submit data identifying percentage of [biobased content for strawboard panels.](#) [ Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for strawboard panels.](#)]

#### ] [2.4.7 Cork

Minimum 85 percent total recycled content. Provide data identifying percentage of [recycled content for cork underlayment.](#) [ Minimum 85 percent biobased content. Provide data identifying percentage of [biobased content for cork underlayment.](#)]

#### ] 2.5 OTHER MATERIALS

##### 2.5.1 Hardboard Underlayment

[DOC/NIST PS58](#), service class, sanded on one side, 1/4 inch thick 4 feet wide.

##### [2.5.2 [Fiberboard Wall Sheathing](#)

[ASTM C208](#), 2 feet wide by [1/2 inch thick for supports 16 inches (o.c.)] [25/32 inch thick for supports 24 inches o.c.] or 4 feet wide by [1/2 inch thick for supports 16 inches o.c.] [3/4 inch thick for supports 24 inches o.c.], except only 4 feet wide by 1/2 inch thick sheathing over supports at 16 inches o.c. may be applied without corner bracing of framing. Sheathing must be asphalt impregnated or asphalt coated to render the sheathing water resistant but vapor permeable. Structural fiberboard must contain a minimum of 80 percent recycled content. Non-structural fiberboard must contain a minimum of [100] [\_\_\_\_\_] percent post-consumer recycled content. Provide data identifying percentage of [recycled content for fiberboard wall sheathing.](#) [ Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for fiberboard wall sheathing.](#)]

## ]2.5.3 Gypsum Wall Sheathing

ASTM C1396/C1396M, 1/2 inch thick [fire retardant (Type X) 5/8 inch thick]; 4 feet wide with square edge [for supports 16 inches o.c. with or without corner bracing of framing] [or] [for supports 24 inches o.c. with corner bracing of framing]; 2 feet wide with V-tongue and groove (T&G) edge for supports [16] [or] [24] inches o.c. with corner bracing of framing.

## 2.5.4 Foil-Faced Insulative Sheathing

Wood fiber core, chemically treated for water resistance, with aluminum foil laminated under pressure to both sides with water-resistant adhesive; 48 inches or 48 3/4 inches wide; 0.078 inch thick when used with corner bracing, 0.115 inch thick with studs up to 16 inches o.c. without corner bracing, or 0.137 inch thick with studs up to 24 inches o.c. without corner bracing. The sheathing and installation must have been accepted by ICC as conforming to ICC IBC. The sheathing alone must have a thermal resistance value (R value) of not less than 0.20.

## 2.5.5 Cellulose Honeycomb Panels

ASTM C208. Panels must be made of [kraft paper] [fire retardant paper] [and must be impregnated with phenolic resins for moisture resistance]. [Panels must contain a minimum of [100] [\_\_\_\_\_] percent post-consumer recycled content. Provide data identifying percentage of recycled content for cellulose honeycomb panels.]

## 2.5.6 Building Paper

FS UU-B-790, Type I, Grade D, Style 1.

## 2.5.7 Trussed Rafters

Metal plate connected trusses designed in accordance with TPI 1 and TPI HIB and fabricated in accordance with TPI 1.

## 2.5.8 Trussed Joists

Metal plate connected parallel chord wood trusses designed and fabricated in accordance with TPI 1.

## 2.5.9 Roof Decking

[ Roof decking must be [commercial] [select] grade with minimum design value of [130] [1100] psi in bending. Decking must be [ 2 inches thick with single tongue and groove] [ 4 inches thick with double tongue and groove]; V-jointed, matched and dressed. As an option, fabricated laminated lumber decking with interlocking tongue and groove joints may be provided.

## ]2.5.10 Miscellaneous Wood Members

## 2.5.10.1 Nonstress Graded Members

Members must include bridging, corner bracing, furring, grounds, and nailing strips. Members must be in accordance with TABLE I for the species used. Sizes must be as follows unless otherwise shown:

Member	Size inch
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x [2] [3]
Grounds	Plaster thickness by 38.
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

#### 2.5.10.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

#### 2.5.10.3 Sill Plates

Sill plates must be standard or number 2 grade.

#### 2.5.10.4 Blocking

Blocking must be standard or number 2 grade.

#### 2.5.10.5 Rough Bucks and Frames

Rough bucks and frames must be straight standard or number 2 grade.

#### 2.5.11 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials and as specified. [ Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building (inside of the weatherproofing system).]

#### 2.6 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware must be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials must be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs

must be hot-dip zinc-coated in accordance with [ASTM A153/A153M](#). [ Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather must be copper alloy or hot-dipped galvanized fasteners as recommended by the treated wood manufacturer.]

#### 2.6.1 Bolts, Nuts, Studs, and Rivets

[ASME B18.2.1](#), [ASME B18.5.2.1M](#), [ASME B18.5.2.2M](#) and [ASME B18.2.2](#).

#### 2.6.2 Anchor Bolts

[ASTM A307](#), size as indicated, complete with nuts and washers.

#### 2.6.3 Expansion Shields

[CID A-A-1923](#), [CID A-A-1924](#), and [CID A-A-1925](#). Except as shown otherwise, maximum size of devices must be  $3/8$  inch.

#### 2.6.4 Lag Screws and Lag Bolts

[ASME B18.2.1](#).

#### 2.6.5 Wood Screws

[ASME B18.6.1](#).

#### 2.6.6 Nails [and Staples]

[ASTM F547](#), size and type best suited for purpose[; staples must be as recommended by the manufacturer of the materials to be joined]. For sheathing and subflooring, length of nails must be sufficient to extend  $1$  inch into supports. In general, 8-penny or larger nails must be used for nailing through  $1$  inch thick lumber and for toe nailing  $2$  inch thick lumber; 16-penny or larger nails must be used for nailing through  $2$  inch thick lumber. Nails used with treated lumber and sheathing must be hot-dipped galvanized in accordance with [ASTM A153/A153M](#). Nailing must be in accordance with the recommended nailing schedule contained in [AWC WFCM](#). Where detailed nailing requirements are not specified, nail size and spacing must be sufficient to develop an adequate strength for the connection. The connection's strength must be verified against the nail capacity tables in [AWC NDS](#). Reasonable judgment backed by experience must ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector must be used.

#### 2.6.7 Wire Nails

[ASTM F1667/F1667M](#).

#### 2.6.8 Timber Connectors

Unless otherwise specified, timber connectors must be in accordance with [TPI 1](#), [APA EWS T300](#) or [AITC TCM](#).

#### 2.6.9 Clip Angles

Steel,  $3/16$  inch thick, size [as indicated] [best suited for intended use]; or zinc-coated steel or iron commercial clips designed for connecting wood members.

#### 2.6.10 Joist Hangers

Steel or iron, zinc coated, sized to fit the supported member, of sufficient strength to develop the full strength of the supported member in accordance with ICC IBC, and furnished complete with any special nails required.

#### 2.6.11 Tie Straps

For joists supported by the lower flange of steel beams, provide 1/8 by 1-1/2 inch steel strap, 2 feet long [, except as indicated otherwise].

#### 2.6.12 Joist Anchors

For joists supported by masonry walls, provide anchors 3/16 by 1 1/2 inch steel tee or strap, bent and of length to provide 4 inches embedment into wall and 12 inches along joist [except as indicated otherwise]. For joists parallel to masonry or concrete walls, provide anchors 1/4 by 1-1/4 inch minimum cross-sectional area, steel strap, length as necessary to extend over top of first three joists and into wall [4] [8] inches, and with wall end of bend or pin type [, except as indicated otherwise].

#### 2.6.13 Door Buck Anchors

Metal anchors, 1/8 by 1-1/4 inch steel, 12 inches long, with ends bent 2 inches [, except as indicated otherwise]. Anchors must be screwed to the backs of bucks and built into masonry or concrete. Locate 8 inches above sills and below heads and not more than 24 inches intermediately between. [Anchorage of bucks to steel framing must be [as indicated] [as necessary to suit the conditions].]

#### 2.6.14 Metal Bridging

[Where not indicated or specified otherwise,] No. 16 U.S. Standard gage, cadmium-plated or zinc-coated.

#### 2.6.15 Toothed Rings and Shear Plates

AWC NDS.

#### 2.6.16 Beam Anchors

Steel U-shaped strap anchors 1/4 inch thick by 1-1/2 inches wide [, except as indicated otherwise].

#### 2.6.17 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, G90. [ Except where otherwise shown,] Steel must be not lighter than 18 gage. Special nails supplied by the manufacturer must be used for all nailing.

#### 2.6.18 Panel Edge Clips

Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

#### 2.7 AIR INFILTRATION BARRIER

Air infiltration barrier must be building paper meeting the requirements of [ASTM C1136](#), Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of [125] [\_\_\_\_\_] g per square meter per 24 hours in accordance with [ASTM E96/E96M](#), Desiccant Method at [23] [\_\_\_\_\_] degrees C or with a moisture vapor transmission rate of [670] [\_\_\_\_\_] g per square meter per 24 hours in accordance with [ASTM E96/E96M](#), Water Method at [23] [\_\_\_\_\_] degrees C.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Conform to [AWC WFCM](#) and install in accordance with the National Association of Home Builders (NAHB) Advanced Framing Techniques: Optimum Value Engineering, unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. [Space plastic lumber boards as necessary to allow for lengthwise expansion and contraction.](#) Do not splice framing members between bearing points. Set joists, rafters, and purlins with their crown edge up. Frame members for the passage of pipes, conduits, and ducts. [Provide adequate support as appropriate to the application, climate, and modulus of elasticity of the product.](#) Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise must be in accordance with the Nailing Schedule contained in [ICC IBC](#); perform bolting in an approved manner. Spikes, nails, and bolts must be drawn up tight. [Install plastic lumber with screws or bolts; if nails are used, use ring shank or spiral shank nails.](#) [Timber connections and fastenings must conform to [AWC NDS](#).] [ Provide 2 inch minimum clearance between chimneys and wood framing; provide 4 inch minimum clearance at fireplaces. Fill the spaces with strips of approved noncombustible material.] Use slate or steel shims when leveling joists, beams, and girders on masonry or concrete. Do not use shimming on wood or metal bearings. When joists, beams, and girders are placed on masonry or concrete, a wood base plate must be positioned and leveled with grout. The joist, beam, or girder must then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket must be formed into the wall. The joist, beam, or girder must then be placed into the pocket and leveled with a steel shim.

#### 3.1.1 Sills

Set sills level and square and wedge with steel or slate shims; point or grout with non-shrinking cement mortar to provide continuous and solid bearing. Anchor sills to the foundations as indicated. [ Where sizes and spacing of anchor bolts are not indicated, provide not less than 5/8 inch diameter bolts at all corners and splices and space at a maximum of 6 feet o.c. between corner bolts. Provide at least two bolts for each sill member. Lap and splice sills at corners and bolt through the laps or butt the ends and through-bolt not more than 6 inches from the ends.] Provide



bolts with plate washers and nuts. Bolts in exterior walls must be zinc-coated.

#### 3.1.1.1 Anchors in Masonry

[Except where indicated otherwise,] Embed anchor bolts not less than 15 inches in masonry unit walls and provide each with a nut and a 2 inch diameter washer at bottom end. Fully grout bolts with mortar.

#### 3.1.1.2 Anchors in Concrete

[Except where indicated otherwise,] Embed anchor bolts not less than 8 inches in poured concrete walls and provide each with a nut and a 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend must be not less than 90 degrees. Powder-actuated fasteners spaced 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

#### 3.1.2 Beams and Girders

Set beams and girders level and in alignment and anchor to bearing walls, piers, or supports with U-shaped steel strap anchors. Embed anchors in concrete or masonry at each bearing and through-bolt to the beams or girders with not less than two bolts. Provide bolts not less than 1/2 inch in diameter and with plate washers under heads and nuts. Install beams and girders [not indicated otherwise] with 8 inch minimum end bearing on walls or supports. Install beams and girders into walls with [ 1/2 inch clearance at the top, end, and sides] [or] [standard steel wall-bearing boxes]. Provide joints and splices over bearings only and bolt or spike together.

#### 3.1.3 Roof Framing or Rafters

Tops of supports or rafters must form a true plane. Valley, ridge, and hip members must be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters and nominally 2 inches thick. Rafters must [be notched and] have full and solid bearing on plates. Valleys, hips, and ridges must be straight and true intersections of roof planes. Necessary crickets and watersheds must be formed. Rafters, except hip and valley rafters, must be [spiked to wall plate and to ceiling joists with no less than three 8-penny nails] [bolted by angles]. Rafters must be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails. Rafters must be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters must be secured to wall plates by clip angles. Openings in roof must be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter must be double. Hip rafters longer than the available lumber must be butt jointed and scabbed. Valley rafters longer than the available lumber must be double, with pieces lapped not less than 4 feet and well spiked together. Install trussed rafters in accordance with TPI HIB. Install engineered wood joists in accordance with distributor's instructions.

#### 3.1.4 Joists

Provide joists of the sizes and spacing indicated, accurately and in alignment, and of uniform width. Joists must have full bearing on sills, [plates,] [beams,] [girders,] [and] [trusses]; provide laps over bearing

only and spike. Where joists are of insufficient length to produce a 12 inch lap, butt joists over bearing and provide wood scabs 2 nominal inches thick by depth of joists by 24 inches long or metal straps 1/4 by 1 1/2 inch by not less than 18 inches long nailed to each joist with not less than four 10-penny nails, or approved sheet metal connectors installed in accordance with the manufacturer's recommendations. Provide joists built into masonry with [a beveled fire cut so that the top of the joist does not enter the wall more than one inch] [or] [standard steel wall bearing boxes]. Provide metal hangers for joists framing into the side of headers, beams, or girders.[ When a portion of the joist extends above the top flange of a steel beam or girder, provide a 3/8 inch space between the top flange and the extended portion of the joists to allow for shrinkage of joists.] The minimum joist end bearing must be 4 inches, and joists built into concrete or masonry must have a 1/2 inch minimum clearance at the top, end, and sides. For joists approved to be bored for the passage of pipes or conduits, bore through the neutral axis of the joist.[ Provide steel joist hangers of proper size and type to receive the ends of all framed joists.]

#### [3.1.4.1 Floor (Ceiling) Framing

Except where otherwise indicated joists must have bearings not less than 4 inches on concrete or masonry and 1-1/2 inches on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels must be carried on joist hangers. Joists must be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors must be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist must be doubled, unless otherwise indicated. Joists built into masonry must be provided with [a beveled fire cut so that the top of the joist does not enter the wall more than 1 inch] [or] [standard steel wall bearing boxes]. Install engineered wood joists in accordance with distributor's instructions.

#### ]3.1.4.2 Doubled Joists

Provide under bearing walls and partitions running parallel with the floor joists[, around [stairways,] [chimneys,] [fireplaces,]] and at other openings where joists are cut and framed. Double, space for clearance, block apart 4 feet on center, rigidly frame, and spike together joists under partitions that are to receive ducts, pipes, and conduits.

#### 3.1.4.3 Tie Straps

For joists supported by the lower flange of steel beams, provide straps at every fourth joist and the corresponding fourth joist on the opposite side. Tie joists across the top of the steel beam with a steel strap. Form straps to lie flat across the top of the beam and twist at the ends to provide flat contact with the side of each joist. Nail each strap at each end with three 10-penny nails spaced 2 inches o.c.

#### 3.1.4.4 Joist Anchors

Provide anchors for each fourth joist supported by a masonry wall. Build wall end of anchors into the wall. Nail anchor to the joist with three 10-penny nails spaced 2 inches o.c. Anchor the first three joists parallel to concrete or masonry walls at bridging points, but not less than 8 feet o.c. from end walls. Let anchors into the tops of each joist and spike to the top of joist with one 10-penny nail. Extend anchors at least [4] [8]

inches into the wall.

### 3.1.5 Bridging

Provide bridging for floor and ceiling joists and for roof rafters having slopes of less than 1/3. Locate bridging as indicated and as specified herein. Provide bridging for spans greater than 6 feet, but do not exceed 8 feet maximum spacing between rows of bridging. Install rows of bridging uniformly. Provide metal or wood cross-bridging, except where solid bridging is indicated. Do not nail the bottom end of cross-bridging until the subfloor has been laid.

#### 3.1.5.1 Wood Cross-Bridging

Provide wood cross-bridging not less than [1 by 3] [2 by 3] [2 by 4] nominal size. Nail wood cross-bridging at each end with [two 8-penny nails for one by thick material] [and] [three 8-penny nails for 2 by thick material.]

#### 3.1.5.2 Metal Cross-Bridging

Must be the manufacturer's standard product, not less than 16 gage before forming and coating. Metal bridging must be the compression type, lodged into or nailed to the wide faces of opposite joists at points diagonally across from each other near the bottoms and tops of joists.

### 3.1.6 Subflooring

#### 3.1.6.1 Plywood, Structural-Use, and OSB Panels

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists. [ Support panel edges by nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking.] Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Panels must be continuous over two or more spans. Nail panels 6 inches o.c. at supported edges and 10 inches o.c. over intermediate bearing. Nails must be 8-penny common or 6-penny threaded. Provide at least 1/2 inch clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D3498 and nails spaced at 12 inches on center unless otherwise shown.

#### 3.1.6.2 Combination Subfloor-Underlayment

Apply with the grain of the face plies or the long dimension at right angles to joists. Panels must be continuous over two or more spans. Stagger end joints of adjacent panels. Panel edges must be T&G or supported by 2 by 4 members framed between joists so the edge joints of subfloor-underlayment occur over the centerline of blocking. Provide end joints of panels over the centerline of joists. Allow 1/8 inch spacing between panel edge and end joints. Nail panels 6 inches o.c. at ends and edges and 10 inches o.c. along intermediate bearings unless they are glue-nailed in accordance with APA E30. Nails must be 8-penny coated common or 6-penny threaded. Provide at least 1/2 inch clearance between subfloor-underlayment and masonry or concrete walls. [ Lightly sand all joints to receive [resilient flooring] [\_\_\_\_\_]. ]

#### 3.1.6.3 Wood

Subflooring must be applied diagonally with end joints made over supports. Each board must bear on at least three supports and must be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width.

#### 3.1.6.4 Depressed Subfloors

Provide depressed subfloors to receive [ceramic] [and] [quarry] tile floors. Nail cleats or ledgers of one by four material to the sides of joists to support the flooring material. Place the cleats at a depth below the top of the joists sufficient to allow the installation of the subflooring below the tops of joists. Snugly fit subflooring as specified herein between joists.

#### 3.1.7 Underlayment

Install underlayment over subfloor just prior to laying of [resilient flooring] [\_\_\_\_\_] and protect from water and physical damage. Stagger end joints of underlayment with respect to each other, and stagger all joints with respect to paralleling panel joints in subfloor. Space panels 1/16 inch apart at ends and 1/8 inch apart at edges and at least 1/2 inch from concrete or masonry walls. Nail panels 6 inches o.c. along edges and 6 inches o.c. each way throughout panel, but not closer than 3/8 inch to panel edges. Nails must be 4-penny annular ring or screw type and must be countersunk 1/16 inch. [ Lightly sand all joints to receive [resilient flooring] [\_\_\_\_\_] .]

#### 3.1.8 Columns and Posts

Set columns and posts, plumb, in alignment, and with full and uniform bearing. Do not embed the bottom and bearing surfaces of [posts] [columns] in concrete or set in direct contact with concrete slabs on grade. [Provide post and beam construction with [wood bolsters] [steel post caps] in such a manner that the post above will tier directly over the one below; fabricate the assembly in a rigid and substantial manner using bolts or lag screws.]

#### 3.1.9 Wall Framing

##### 3.1.9.1 Studs

Select studs for straightness and set plumb, true, and in alignment. In walls and partitions more than 8 feet tall, provide horizontal bridging at not more than 8 feet o.c. using nominal 2 inch material of the same width as the studs; install the bridging flat. Sizes and spacing of studs must be [\_\_\_\_\_] [as indicated]. Double studs at jambs and heads of openings and triple at corners to form corner posts. Frame corner posts to receive sheathing, lath, and interior finish. Truss over openings exceeding 4 feet in width or use a header of sufficient depth. Toe-nail studs to sills or sole plates with four 8-penny nails or fasten with metal nailing clips or connectors. Anchor studs abutting concrete or masonry walls thereto near the top and bottom and at midheight of each story using expansion bolts or powder-actuated drive studs.

##### 3.1.9.2 Plates

Use plates for walls and partitions of the same width as the studs to form continuous horizontal ties. Splice single plates; stagger the ends of double plates. Double top plates in walls and bearing partitions, built up of two nominal 2 inch thick members. Top plates for nonbearing partitions

must be single or double plates of the same size as the studs. Nail lower members of double top plates and single top plates to each stud and corner post with two 16-penny nails. Nail the upper members of double plates to the lower members with 10-penny nails, two near each end, and stagger 16 inches o.c. intermediately between. Nail sole plates on wood construction through the subfloor to each joist and header; stagger nails. Anchor sole plates on concrete with expansion bolts, one near each end and at not more than 6 feet o.c., or with powder-actuated fasteners, one near each end and at not more than 3 feet o.c. Provide plates cut for the passage of pipes or ducts with a steel angle as a tie for the plate and bearing for joist.

#### 3.1.9.3 Firestops

Provide firestops for wood framed walls and partitions and for furred spaces of concrete or masonry walls at each floor level and at the ceiling line in the top story. Where firestops are not automatically provided by the framing system used, they must be formed of closely fitted wood blocks of nominal 2 inch thick material of the same width as the [studs] [and] [joists]. [ Lightweight concrete units may be used at the first-floor level to serve jointly as firestopping and ratproofing.]

#### 3.1.9.4 Diagonal Bracing

Provide diagonal bracing at all external corners and internal angles and at maximum 40 foot centers in stud walls, except that bracing may be omitted where diagonally applied wood sheathing, plywood or structural-use panel sheathing, 4 by 8 foot fiberboard sheathing, or gypsum board sheathing is used. Bracing must be of 1 by 6 material, let into the exterior face of studs. Extend bracing from top plates to sill at an angle of approximately 45 degrees and double nail at each stud. When openings occur near corners, provide diagonal knee braces extending from the corner post above headers to top plates and from below window sills to the main sill. Nail bracing at each bearing with two 8-penny nails.

#### 3.1.10 Wall Sheathing

##### 3.1.10.1 Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 1/8 inch spacing between panels and 1/8 inch at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 6 inches o.c. along edges of the panel and 12 inches o.c. over intermediate supports. Keep nails 3/8 inches away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

##### 3.1.10.2 Fiberboard Wall Sheathing

Apply fiberboard wall sheathing allowing a 1/8 inch joint at edges to permit expansion, except at frames and openings where sheathing must be fitted snugly. Pre-expand sheathing before application, allowing sheathing to condition for humidity as recommended by the sheathing manufacturer. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

- a. Fiberboard wall sheathing used with diagonal-braced framing must be either 2 or 4 feet wide. Sheathing 2 feet wide must have T&G or shiplapped edges and must be applied horizontally with vertical joints staggered. Apply sheathing with tongued edge up and nail at edges and

intermediate bearings with 1-3/4 inch long, zinc-coated steel roofing nails spaced on maximum 4-1/2 inch centers. Apply sheathing 4 feet wide either horizontally or vertically. Nail sheathing with 1-3/4 inch long, zinc-coated steel roofing nails spaced 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.

- b. Fiberboard wall sheathing used with unbraced framing must be 4 feet wide. Apply sheathing vertically. Extend sheathing over and nail to sill and top plates. Locate joints over centerlines of supports. Nail sheathing with 1-1/2 inch long, zinc-coated steel roofing nails with 3/8 inch diameter heads. Space nails 3 inches o.c. at edges and ends and 6 inches o.c. at intermediate bearings.

#### 3.1.10.3 Gypsum Sheathing Board

Apply gypsum sheathing board either horizontally or vertically. Butt joints and locate over the centerlines of supports. Horizontally applied sheathing must be T&G, applied with tongued edge up. Stagger vertical joints and abut sheet closely to frames of openings. Nail sheathing with 11 gage, 3/8 inch head, zinc-coated nails 1-1/2 inches long for 1/2 inch sheathing and 1-3/4 inches long for 5/8 inch sheathing, spaced 3/8 inch minimum from edges. Provide 2 by 4 blocking for horizontal edges of 4 foot wide panels not otherwise supported.

- a. Gypsum Sheathing Board Used with Diagonal-Braced Framing: Sheathing must be either 2 or 4 feet wide. Apply sheathing 2 feet wide horizontally. Nail 4 inches maximum o.c. at edges and over intermediate bearings. Apply sheathing 4 feet wide either horizontally or vertically. Nail 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.
- b. Gypsum Sheathing Board Used with Unbraced Frames: Sheathing must be 4 feet wide and applied vertically. Extend sheathing over and nail to both sill and top plates. Nail 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.

#### 3.1.10.4 Foil-Faced Insulative Sheathing

Apply sheathing vertically. Butt or overlap joints and locate over centerline of supports. Attach sheathing to framing with 1-1/4 inch, large, flat-head, 11 gage, galvanized roofing nails or 16 gage, 7/16 inch minimum crown, galvanized staples with 1-1/4 inch legs. For nonstructural application (with corner bracing), space fasteners 6 inches o.c. on all panel edges and 12 inches o.c. on intermediate supports, regardless of sheathing thickness, for studs not more than 24 inches o.c. For structural application (without corner bracing), for studs not more than 16 inches o.c., space fasteners 3 inches o.c. on all edges and 6 inches o.c. on intermediate members using minimum 0.115 inch thickness; for studs up to 24 inches o.c., space fasteners 3 inches o.c. on all edges and 3 inches o.c. on intermediate supports using minimum 0.137 inch thickness.

#### 3.1.10.5 Particleboard

Install according to manufacturer's instructions and accepted industry standards.

#### 3.1.10.6 Cellulose Honeycomb Panels

Install according to manufacturer's instructions and accepted industry

standards.

#### 3.1.11 Wood Sheathing

Sheathing end joints must be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board must bear on at least three supports. Boards must be nailed at each support using two nails for boards 6 inches and less in width and three nails for boards more than 6 inches in width. Roof sheathing must not be installed where roof decking is installed.

#### 3.1.12 Building Paper

Provide building paper [where indicated] [on wood board sheathing for all types of exterior siding]. Apply paper shingle fashion, horizontally, beginning at the bottom of the wall. Lap edges 4 inches, and nail with one inch, zinc-coated roofing nails, spaced 12 inches o.c. and driven through tin discs.

#### 3.1.13 Ceiling Joists

Size as indicated and set accurately and in alignment. Toe-nail joists to all plates with not less than three 10-penny nails. Frame openings in ceilings with headers and trimmers.

#### 3.1.14 Metal Framing Anchors

Provide framing anchors at every [other] [rafter] [or] [trussed rafter] to fasten [rafter] [or] [trussed rafter] to plates and studs against uplift movement and forces as indicated. Anchors must be punched and formed for nailing so that nails will be stressed in shear only. Nails must be zinc-coated; drive a nail in each nail hole provided in the anchor.

#### 3.1.15 Trusses

Metal plate connected wood trusses must be handled, erected, and braced in accordance with TPI HIB and as indicated.

#### 3.1.16 Structural Glued Laminated Timber Members

Brace members before erection. Align members and complete all connections before removal of bracing. Unwrap individually wrapped members only after adequate protection by a roof or other cover has been provided. Treat scratches and abrasions of factory applied sealer with two brush coats of the same sealer used at the factory.

#### 3.1.17 Plywood and Structural-Use Panel Roof Sheathing

Install with the grain of the outer plies or long dimension at right angles to supports. Stagger end joints and locate over the centerlines of supports. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Nail panels with 8-penny common nails or 6-penny annular rings or screw-type nails spaced 6 inches o.c. at supported edges and 12 inches o.c. at intermediate bearings. Do not use staples in roof sheathing. Where the support spacing exceeds the maximum span for an unsupported edge, provide adequate blocking, tongue-and-groove edges, or panel edge clips, in accordance with APA E30.

#### 3.1.18 Stair Framing

Cut carriages to exact shape required to receive treads and risers, with risers of uniform height and treads of uniform width. Provide trimmers, nailers, and blocking as required to support finish materials.

### 3.1.19 Plastic Lumber

In conjunction with above requirements, follow manufacturer's recommendations for plastic lumber installation, including requirements for structural support, thermal movement, working, fastening, and finishing. Use standard woodworking tools, including carbide tips, coarse saw blades, and routers with aggressive cutters. Follow manufacturer's recommendations for repair by melting.

## 3.2 MISCELLANEOUS

### 3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

#### 3.2.1.1 Roof Nailing Strips

Provide roof nailing strips for roof decks as [indicated] [and] [specified herein]. Apply nailing strips in straight parallel rows in the direction and spacing[ indicated][ specified in [\_\_\_\_]]. Strips must be[ surface applied][ embedded in concrete].

- a. Surface-Applied Nailers: Must be 3 inches wide and of thickness to finish flush with the top of the insulation. Anchor strips securely to the roof deck with powder actuated fastening devices or expansion shields and bolts, spaced not more than 24 inches o.c.[ On decks with slopes of one inch or more, provide surface applied wood nailers for securing insulation[ and for nailing of roofing felts].]
- b. Embedded Nailers: Must be nominal 2 by 3 with 2 inch sides beveled. Set and anchor nailers to finish flush with the roof deck surface.

#### 3.2.1.2 Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers must be 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM 4435.[ Strips must be grooved [as indicated] for edge venting; install at walls, curbs, and other vertical surfaces with a 1/4 to 1/2 inch air space.]

#### 3.2.1.3 Crickets, Cants, and Curbs

Provide wood saddles or crickets, cant strips, [curbs for scuttles and ventilators,] [and wood nailers bolted to tops of concrete or masonry curbs] [and at expansion joints,] as indicated, specified, or necessary and of [lumber] [or [\_\_\_\_] inch thick exterior plywood].

#### 3.2.2 Rough Wood Bucks

[Size as indicated] [ 2 inch nominal thickness]. Set wood bucks true and plumb. Anchor bucks to concrete or masonry with steel straps extending



into the wall 8 inches minimum. Place anchors near the top and bottom of the buck and space uniformly at 2 foot maximum intervals.

### 3.2.3 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

### 3.2.4 Wood Grounds

Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with an 8 foot straightedge.

### 3.2.5 Wood Furring

Provide where shown and as necessary for facing materials specified. Except as shown otherwise, furring strips must be nominal one by 3, continuous, and spaced 16 inches o.c. Erect furring vertically or horizontally as necessary. Nail furring strips to masonry. Do not use wood plugs. Provide furring strips around openings, behind bases, and at angles and corners. Furring must be plumb, rigid, and level and must be shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required. Form furring for [cornices,] offsets and breaks in walls or ceilings on 1 by 4 wood strips spaced 16 inches o.c.

### 3.2.6 Wood Bumpers

Dress to the sizes indicated, and bevel edges. Bore, countersink, and bolt bumpers in place.

### 3.2.7 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

### 3.2.8 Temporary Centering, Bracing, and Shoring

Provide for the support and protection of masonry work during construction as specified in Section [\_\_\_\_]. Forms and centering for cast-in-place concrete work are specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 3.2.9 Wood Sleepers

Run wood sleepers in lengths as long as practicable and stagger end joints in adjacent rows. [ Sleepers for gymnasium floors are specified in Section 09 64 66 WOOD ATHLETIC FLOORING.]

### 3.2.10 Diaphragms

Install plywood, structural-use, or OSB panels with the long dimension [parallel] [perpendicular] to supports. End joints must be [continuous] [staggered] and located over the centerline of supports. Longitudinal joints must be [continuous] [staggered] [and provided with blocking]. Nail panels with [6] [8] [10]-penny nails spaced not more than [\_\_\_\_] inches on

centers around the diaphragm boundaries [and along continuous panel edges] and [\_\_\_\_\_] inches on centers at all other supported edges and 12 inches o.c. over intermediate bearings.

#### 3.2.11 Shear Walls

Install plywood or structural-use panels with long dimension parallel or perpendicular to supports. Provide blocking behind edges not located over supports. Nail panels with [6] [8] [10]-penny nails spaced not more than [\_\_\_\_\_] inches on centers along panel edges and 6 inches o.c. over intermediate bearings.

#### 3.2.12 Bridging

Wood bridging must have ends accurately bevel-cut to afford firm contact and must be nailed at each end with two nails. Install metal bridging as recommended by the manufacturer. The lower ends of bridging must be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

#### 3.2.13 Corner Bracing

Install corner bracing when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing must be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, must extend completely over wall plates, and must be secured at each bearing with two nails.

#### 3.2.14 Sill Plates

Sill plates must be set level and square and anchor bolted at not more than 6 feet on centers and not more than 12 inches from end of each piece. A minimum of two anchors must be used for each piece.

### 3.3 INSTALLATION OF TIMBER CONNECTORS

Install timber connectors in conformance with requirements of AWC NDS.

### 3.4 ERECTION TOLERANCES

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, must be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
  - (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
  - (4) Face of framing members: 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive must be within the following limits:
  - (1) Layout of walls and partitions: 1/4 inch from intended position;
  - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;

(3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 1/8 in 8 feet from a true plane.

### [3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components must be done in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

### ]3.6 WASTE MANAGEMENT OF WOOD PRODUCTS

In accordance with the Waste Management Plan and as specified. [ Separate and reuse scrap sheet materials larger than [2 square feet] [\_\_\_\_], framing members larger than [16 inches] [\_\_\_\_], and multiple offcuts of any size larger than [12 inches] [\_\_\_\_].] Clearly separate damaged wood and other scrap lumber for acceptable alternative uses on site, including bracing, blocking, cripples, ties, and shims.

[Separate composite wood from other wood types and recycle or reuse.] [Coordinate with manufacturer for take-back program and submit manufacturer's policy statement on program.] [Set aside scrap [plastic lumber] and return to manufacturer for recycling into new product. When such a service is not available, local recyclers must be sought after to reclaim the materials.] [ Fold up metal banding, flatten, and recycle.]

Separate treated, stained, painted, and contaminated wood and place in designated area for hazardous materials. Dispose of according to local regulations. [ Do not leave any wood, shavings, sawdust, or other wood waste buried in fill or on the ground[, unless for planned future use].] [ Prevent sawdust and wood shavings from entering the storm drainage system.] [Compost sawdust. ]Do not burn scrap lumber that has been pressure treated, or lumber that is less than one year old.

-- End of Section --

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## SECTION 06 18 00

## GLUED-LAMINATED CONSTRUCTION

08/16, CHG 1: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

- AITC 109** (2007) Standard for Preservative Treatment of Structural Glued Laminated Timber
- AITC 111** (2005) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
- AITC 113** (2010) Standard for Dimensions of Structural Glued Laminated Timber
- AITC 119** (1996) Standard Specifications for Structural Glued Laminated Timber of Hardwood Species

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

- ASCE 7-16** (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- ASME B18.21.1** (2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

## AMERICAN WOOD COUNCIL (AWC)

- AWC NDS** (2015) National Design Specification (NDS) for Wood Construction

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

- AWPA T1** (2022) Use Category System: Processing and Treatment Standard
- AWPA U1** (2022) Use Category System: User Specification for Treated Wood

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

- ANSI 117** (2008) Standard Specifications for Structural Glued Laminated Timber of

## Softwood Species

ANSI 405	(2012) Standard for Adhesives for use in Structural Glued Laminated Timber
ANSI A190.1	(2012) Standard for Wood Products - Structural Glued Laminated Timber
APA E30	(2016) Engineered Wood Construction Guide
APA EWS R540	(2013) Builder Tips: Proper Storage and Handling of Glulam Beams
APA EWS T300	(2007) Technical Note: Glulam Connection Details
APA S580	(2013) Preservative Treatment of Glued Laminated Timber

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM D2559	(2012a; E 2016) Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions
ASTM D3737	(2018; E2018) Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
SOUTHERN PINE INSPECTION BUREAU (SPIB)	
SPIB 1003	(2014) Standard Grading Rules for Southern Pine Lumber
U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)	
QPL-19140	(2018) Lumber and Plywood, Fire-Retardant Treated
UNDERWRITERS LABORATORIES (UL)	
UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)	
WWPA G-5	(2017) Western Lumber Grading Rules

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Fabrication Drawings

Installation Drawings; G[, [\_\_\_\_]]

### SD-04 Samples

Exposed-to-View Surfaces; G[, [\_\_\_\_]]

### SD-07 Certificates

Glued-Laminated Structural Members

Structural Members

Design Load Compliance

### SD-08 Manufacturer's Instructions

Laminated Wood Materials

Adhesive

## 1.3 QUALITY CONTROL

### 1.3.1 Qualifications for Laminating Wood Manufacturer

Provide factory glued-laminated structural wood members produced by an American Institute of Timber Construction (AITC) or (APA) Engineered Wood Association licensed manufacturer. Factory mark every member of the structural glued-laminated timber with AITC Quality Mark or APA trademark and provide a certificate of conformance. Manufacture the laminated timber meeting the requirements of [AITC 119], APA E30, ASTM D3737, ANSI A190.1, and WWPA G-5.

#### 1.3.2 Certifications

Submit certificates for glued-laminated structural members include a product report or laboratory report issued by a US Product certification Agency under ISO 17065 or a US inspection agency accredited under ISO 17020. Include the following information:

- a. Glulam manufacturers' name
- b. Glulam grade

Include in report the results of tests, shear strength, and durability of the glue line. Ensure compliance with the requirements of ASTM D3737. Ensure material tested is typical of a production run of the same material used in the project. Ensure tests are conducted from the same product lot prior to delivery of the wood.

Provide certification that structural members meet the requirements of ANSI A190.1 and ANSI 117.

Submit signed and sealed documentation prepared by a licensed professional [Engineer] [Architect] verifying design load compliance with ASCE 7-16 and ICC IBC.

#### 1.3.3 Surfaces

Submit three samples; 12 inches long of sufficient width and thickness to illustrate the quality and color of exposed-to-view surfaces.

#### 1.4 DELIVERY, HANDLING, AND STORAGE

Deliver the glued-laminated wood structural members in quantities indicated and at construction scheduled times to ensure the continuity of the installation of the structural members and the progress of the erection schedules. Reference AITC 111 and APA EWS R540 for further information.

Deliver packaged or wrapped materials in their original, undamaged wrapping, bearing label clearly identifying manufacturer's name, grade and species of lumber, type of glue, and other pertinent data. Use nonmarring slings for loading, unloading, and handling members to prevent damage to surfaces or wrapping.

Store wrapped materials in their original wrapping until ready for installation.

Place members on level supports off ground, spaced and braced to allow through ventilation. Cover wood and keep free of dirt, grease, moisture, or foreign matter that could cause staining.

#### PART 2 PRODUCTS



## 2.1 SYSTEM DESCRIPTION

### 2.1.1 Drawings

Verify all field measurements prior to preparation of fabrication and installation drawings to ensure proper fitting of the work.

Submit [fabrication drawings](#) for glue-laminated structural units consisting of fabrication and assembly details performed in the factory.

## 2.2 MATERIALS

### 2.2.1 General

Provide structural glued-laminated timber complying with [AITC 113](#), [ANSI 117](#), and [ANSI A190.1](#), [AWC NDS](#), [ and [AITC 119](#)].

Provide structural glued-laminated timber manufactured in accordance with [ANSI 117](#), and [ANSI A190.1](#).

#### 2.2.1.1 Lumber

- [ Species and grade: [Insert Hardwood Species selected] in accordance with the provisions of [AITC 119](#).
- ] [Species and grade: [Douglas fir] [larch], graded in accordance with the grading provisions of [WWPA G-5](#).
- ] [Species and grade: Southern Pine, graded by the same basic provisions as used for solid sawn lumber in [SPIB 1003](#).
- ] [Provide species and grade meeting the structural requirements of [ASTM D3737](#), [AITC 113](#), [[ANSI 117](#)] [[AITC 119](#)] and [applicable building codes] [[ASCE 7-16](#)] [[ICC IBC](#)].
- ] [Provide glued-laminated kiln-dried and stress-graded lumber meeting the requirements of [[ANSI 117](#)] [[AITC 119](#)].
- ] [Determine species and grade combination by the design requirements for each component and as designated on the shop drawings. Use AITC lumber combination symbols for this identification.
- ] Use only glued-laminated structural members having a maximum moisture content of 15-percent throughout the entire piece before surfacing and bonding.

Provide glued-laminated structural members of [ANSI A190.1](#) [Premium] [Architectural] [Industrial] [Framing] Grade, conforming to the standards.

### 2.2.2 Preservative and Fire-Retardant Treatment

Pressure impregnate fire-retardant treated wood with an approved process in accordance with [AITC 109](#), [APA S580](#), [AWPA T1](#), and [AWPA U1](#).

Treat structural members to attain a UL flame spread rating not greater than 25, showing no evidence of progressive combustion when tested for 30 minutes in accordance with [UL 723](#) and [ASTM E84](#).

Ensure penetration of fire-retardant material in treated wood in accordance with [QPL-19140](#). Determine depth of penetration by borer cores taken from 20 pieces of each charge and test. If 80 percent of the borings meet the penetration requirements, the charge is acceptable.

Kiln dry the wood after treatment to remove the moisture injected during treatment. Average moisture content is not to exceed 19 percent.

### 2.2.3 Adhesive

Bond glued-laminated members with a waterproof adhesive conforming to the test requirements of [ASTM D2559](#) and [ANSI 405](#) for exterior glue, shear strength and durability.

### 2.2.4 Finishes

- [ Provide glued-laminated members with manufacturer's standard wiped stain finish, dry-appearance, penetrating acrylic stain and sealer; oven dried with mildew and fungus resistance.
- ] [Provide glued-laminated members with manufacturer's standard clear finish, two-coat, clear conversion varnish finish; oven dried with mildew and fungus resistance.
- ] [Provide glued-laminated members with one factory-applied coat of sealer to the ends of members immediately after trimming, and other surfaces dressed with one coat of penetrating clear sealer.
- ] [Provide glued-laminated members with one factory-applied coat of sealer to the ends of members immediately after trimming. No other sealer is required.
- ] [Provide unfinished glued-laminated members after final surfacing and sanding.
- ] [Provide glued-laminated members with standard factory wiped stain and clear varnish finish [as indicated by manufacturer's designations] [match sample] [as selected from manufacturer's full range] [insert color].
- ]

### 2.2.5 Timber Hardware

- [ Provide structural steel shapes, plates, and flat bars as indicated for assembly and connection of members conforming to [ASTM A36/A36M](#).
- ] [Provide hot-rolled steel sheet complying with [ASTM A1011/A1011M](#), structural steel, Type SS, Grade 33.
- ] [Provide stainless steel bars and shapes complying with [ASTM A276/A276M](#) [Type 304] [Type 316].
- ] [Provide stainless steel plate, flat bars, and sheets complying with [ASTM A666](#) [Type 304] [Type 316].
- ]
- Provide low carbon steel anchor bolts with regular hexagon nuts and carbon steel washers. Provide anchor bolts and nuts conforming to [ASTM A307](#).

Provide plain washers conforming to [ASME B18.21.1](#).

Clean oil, dirt, rust, and foreign matter from all metal surfaces. For

exterior locations, provide hot-dipped galvanized hardware in accordance with [ASTM A153/A153M](#), with coating weight as required for Class [A] [B] [C] [D] material as described therein. Coat other metal surfaces with one coat of manufacturer's standard rust-resisting metal primer applied at a minimum dry-film thickness of 1.5 mils.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Manufacturer's Information

Submit manufacturer's instructions for [laminated wood materials](#) and [adhesive](#) including special provisions required to install equipment components and system packages. Detail with special notices all impedances, hazards and safety precautions.

##### 3.1.2 Installation Drawings

Submit [installation drawings](#) for glue-laminated structural units showing dimensions of laminated wood members, location, size, and type of reinforcement. Include any reinforcement necessary for safe handling and erection of structural members. Identify each structural member and the corresponding sequence and procedure followed during installation. Identify location and details of anchorage devices that are embedded in other construction on layout drawings.

##### 3.1.3 Construction

Conform spacing and placement of members and installation methods in accordance with [APA EWS T300](#).

Plan and execute erection procedures so that close fit and neat appearance of joints and structure as a whole is not impaired. When hoisting members into place, use padded or non-marring slings. Protect corners with wood blocking. Brace members as they are placed to maintain a safe position until full stability is achieved.

Avoid cutting glulam members during erection to the greatest extent possible. Except for fastener drilling and other minor cutting, coat cuts with end sealer.

##### 3.1.4 Protection

After installation, cover each member with a temporary waterproof protection to maintain the moisture content of the wood. Maintain protection until members are enclosed within the building and final coats are ready for application. Elevate initial building heat gradually to the desired level. To minimize checking do not reduce the relative humidity of the building rapidly.

-- End of Section --

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## SECTION 06 20 00

FINISH CARPENTRY  
08/16, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## AMERICAN HARDBOARD ASSOCIATION (AHA)

**AHA A135.4** (1995; R 2004) Basic Hardboard

**AHA A135.6** (1998; R 2006) Hardboard Siding

## AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

**ALSC PS 20** (2015) American Softwood Lumber Standard

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

**ASME B18.2.1** (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

**ASME B18.2.2** (2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

**ASME B18.6.1** (2016) Wood Screws (Inch Series)

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

**AWPA M4** (2021) Standard for the Care of Preservative-Treated Wood Products

**AWPA U1** (2022) Use Category System: User Specification for Treated Wood

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

**APA E445** (2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)

**APA L870** (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

**APA S350** (2014) PS 2-10, Performance Standard for Wood-Based Structural-Use Panels

## ASTM INTERNATIONAL (ASTM)

- ASTM D2898** (2010; R 2017) Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
- ASTM F547** (2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

- ANSI/BHMA A156.9** (2020) Cabinet Hardware

## CALIFORNIA AIR RESOURCES BOARD (CARB)

- CARB 93120** (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

- CDPH SECTION 01350** (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## COMPOSITE PANEL ASSOCIATION (CPA)

- CPA A208.1** (2016) Particleboard

## CSA GROUP (CSA)

- CSA Z809-08** (R2013) Sustainable Forest Management

## FOREST STEWARDSHIP COUNCIL (FSC)

- FSC STD 01 001** (2015) Principles and Criteria for Forest Stewardship

## GREEN SEAL (GS)

- GS-36** (2013) Adhesives for Commercial Use

## HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

- HPVA HP-1** (2016) American National Standard for Hardwood and Decorative Plywood

## INTERNATIONAL CODE COUNCIL (ICC)

- ICC IBC** (2018) International Building Code

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI/NEMA LD 3** (2005) Standard for High-Pressure Decorative Laminates

## NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

**NHLA Rules** (2015) Rules for the Measurement & Inspection of Hardwood & Cypress

## NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

**NELMA Grading Rules** (2013) Standard Grading Rules for Northeastern Lumber

## PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

**PEFC ST 2002:2013** (2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

## REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

**RIS Grade Use** (1998) Redwood Lumber Grades and Uses

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

**SCAQMD Rule 1168** (2017) Adhesive and Sealant Applications

## SOUTHERN PINE INSPECTION BUREAU (SPIB)

**SPIB 1003** (2014) Standard Grading Rules for Southern Pine Lumber

## SUSTAINABLE FOREST INITIATIVE (SFI)

**SFI 2015-2019** (2015) Standards, Rules for Label Use, Procedures and Guidance

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**40 CFR 770** Formaldehyde Standards for Composite Wood Products

## UNDERWRITERS LABORATORIES (UL)

**UL 2818** (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

**WCLIB 17** (2015) Standard Grading Rules

## WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

**WWPA G-5** (2017) Western Lumber Grading Rules

## WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

**WDMA I.S.4** (2015A) Preservative Treatment for Millwork

## WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6

(2007) Quality Industry Standards Booklet

WOODWORK INSTITUTE (WI)

NAAWS 3.1

(2017; 2018 Errata Edition) North American  
Architectural Woodwork Standards

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings Indicating All Wood Assemblies; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Wood Products; G[, [\_\_\_\_\_]]

Countertops; G[, [\_\_\_\_\_]]

Engineered Wood Products; G[, [\_\_\_\_\_]]

Treated Wood Products; G[, [\_\_\_\_\_]]

Soffits; G[, [\_\_\_\_\_]]

Fascias and Trim; G[, [\_\_\_\_\_]]

Hardware and Accessories; G[, [\_\_\_\_\_]]

[ VOC Content for Siding; S

][ Recycled Content for MDF/Particleboard; S

## ] SD-04 Samples

Samples; G[, [\_\_\_\_\_]]

## SD-07 Certificates

Certificates of Grade; G[, [\_\_\_\_\_]]

[ Certified Sustainably Harvested Wood for Trim and Frames; S

][ Certified Sustainably Harvested Softwood Plywood; S

][ Certified Sustainably Harvested Hardwood Plywood; S

][ Certified Sustainably Harvested Hardboard; S

][ Certified Sustainably Harvested Siding; S



- ] [ Indoor Air Quality for Hardwood Plywood; S
- ] [ Indoor Air Quality for MDF and Particleboard; S
- ] [ Indoor Air Quality for Non-aerosol Adhesives; S
- ] [ Indoor Air Quality for Aerosol Adhesives; S

### ] 1.3 DETAIL DRAWINGS

Submit [detail drawings](#) indicating all wood assemblies proposed for use in the project. Indicate materials, species, grade, density, grain, finish details of construction, location of use in the project, finishes, types, method and arrangement of fasteners, and installation details. This includes all fabricated assemblies.

### 1.4 PRODUCT DATA

Submit Manufacturers printed data including proposed species, grade, density grain, and finish as applicable; sufficient to demonstrate compliance with this specification for each type of wood product specified. For [treated wood products](#) also provide documentation of environmentally safe preservatives for each type of wood product specified.

Provide Manufacturers printed data for hardware and all wood accessories including but not limited to edge banding, adhesives, and sealers.

### 1.5 SAMPLES

Samples indicating proposed species, grade, density grain, and finish for each type of wood product specified. Provide samples of sufficient size to show pattern and color ranges of proposed products.

### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver wood products to the jobsite in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well ventilated enclosure and protect against extreme changes in temperature and humidity. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Do not store products in building until wet trade materials are dry and humidity of the space is within wood manufacturer's tolerance limits for storage.

### 1.7 QUALITY ASSURANCE

#### 1.7.1 Certifications

##### 1.7.1.1 Certified Wood Grades

Provide [certificates of grade](#) from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

##### [1.7.1.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by [FSC STD 01 001](#) [, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019](#), or other third party program

certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

]1.7.1.3 Indoor Air Quality Certifications

1.7.1.3.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.7.1.3.2 Composite Wood Products

For purposes of this specification, composite wood products include hardwood plywood, particleboard, medium density fiberboard (MDF), panel substrates, and door cores. Provide products certified to meet requirements of both [40 CFR 770](#) and [CARB 93120](#). Provide current product certification documentation from certification body.

]1.7.2 Lumber

Identify each piece or each bundle of lumber, millwork, and trim by the grade mark of a recognized association or independent inspection agency certified by the Board of Review of the ALSC to grade the species.

1.7.3 Plywood

Provide each sheet of plywood with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. Marks must identify plywood by species group or span rating, exposure durability classification, grade, and compliance with [APA L870](#).

1.7.4 Hardboard [and Particleboard]

Provide materials marks or written documentation identifying the producer and the applicable standard.

1.7.5 Pressure Treated Lumber and Plywood

Inspect each treated piece in accordance with [AWPA U1](#).

1.7.6 Non-Pressure Treated Woodwork and Millwork

Mark, stamp, or label to indicate compliance with [WDMA I.S.4](#).

1.7.7 Fire-Retardant Treated Lumber

Each piece must bear an Underwriters Laboratories fire resistance label or comparable label of another nationally recognized independent fire retardant materials testing laboratory.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS

2.1.1 Sizes and Patterns of Wood Products

Provide yard and board lumber sizes in accordance with [ALSC PS 20](#). Provide shaped lumber and millwork in the patterns indicated and in standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes. Provide actual sizes within manufacturing tolerances allowed by the applicable standard.

2.1.2 Species and Grades

Provide in accordance with [AWPA U1](#) Use Category System Tables unless otherwise specified herein.

2.1.3 Trim, Finish, and Frames

Provide species and grades listed in the table below for wood materials that must be painted. For materials that must be stained, have a natural, or a transparent finish, provide materials one grade higher than those listed in the table below. Provide trim, except window stools and aprons with hollow backs. [ Provide [certified sustainably harvested wood for trim and frames](#).]

<u>TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH</u>		
Grading Rules	Species	Exterior and Interior Trim, Finish, and Frames
<a href="#">WWPA G-5</a> standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, (Ponderosa Pine-Lodgepole Pine,) White Woods, (Western Woods,) Western Cedars, Western Hemlock	All Species: C & BTR. Select (Choice & BTR Idaho White Pine) or Superior Finish. Western Red Cedar may be graded C & BTR. Select or A & BTR in accordance with Special Western Red Cedar Rules.
<a href="#">WCLIB 17</a> standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: C & BTR VG, except A for Western Red Cedar

TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH		
Grading Rules	Species	Exterior and Interior Trim, Finish, and Frames
SPIB 1003 standard grading rules	Southern Pine	C & BTR
NHLA Rules	Cypress	C-Select
NELMA Grading Rules standard grading rules **	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern White Cedar	All Species: C-Select except C & BTR for Eastern White Pine and Norway Pine
RIS Grade Use standard specifications	Redwood	Clear, Clear All Heart
NHLA Rules	Cypress	B Finish
	Red Gum, Soft Elm, Birch	Select or BTR (for interior use only)

Note: \*\*

<http://www.nelma.org/library/2013-standard-grading-rules-for-northeastern-lumber/>

#### 2.1.4 Utility Shelving

Provide utility shelving in a suitable species equal to or exceeding the requirements of No. 3 common white fir under WWPA G-5, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

#### 2.1.5 Softwood Plywood

Provide in accordance with APA L870. [ Provide certified sustainably harvested softwood plywood. ] [ When located on the interior of buildings, provide products with no added urea-formaldehyde resins. ]

- a. Plywood for Soffits: Exterior type, B-B medium density overlay.
- b. Plywood for Shelving: Interior type, [A-B] [B-B] Grade, any species group.
- c. Plywood for Countertops: Exterior type, A-C Grade.

#### 2.1.6 Hardwood Plywood

HPVA HP-1, Type [Technical (Exterior)] [I (Exterior)] [II (Interior)] [III (Interior)], [Premium (A)] [Good (1)] [Sound (2)] [Utility (3)] [Backing (4)] [Specialty (SP)] Grade, [hardwood veneer core construction,] [lumber core construction,] face veneers of [\_\_\_\_], of thickness indicated. [ Provide certified sustainably harvested hardwood plywood. ] [ When located

on the interior of buildings, provide products with no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for hardwood plywood.](#)]

#### 2.1.7 Hardboard

[AHA A135.4](#), [standard] [tempered] [service] type, [1/8] [1/4] inch thick. [ Provide [certified sustainably harvested hardboard.](#)]

#### [2.1.8 Medium Density Fiberboard (MDF) and Particleboard

[CPA A208.1](#), Grade 1-M-2 or 2-M-2 or better. [ For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for MDF and particleboard.](#)]

Provide products with 80 percent total recovered materials content. Provide data identifying percentage of [recycled content for MDF/particleboard.](#)

#### ]2.1.9 Stairs

Treads [1-1/4 inches](#) thickness, clear red or white oak. Risers [1 inch](#) nominal finish lumber.

#### 2.1.10 Shoe Mould

Clear red or white oak, [1/2 by 5/8 inch](#) unless otherwise indicated.

#### 2.1.11 Wood Seats

Clear maple, oak, or other suitable hardwood, not less than [1-5/8 inches](#) thick, with rounded edges. Provide stainless steel stanchions or brackets.

#### 2.1.12 Wood Bumpers

Clear oak[, maple] [, birch] [or] [\_\_\_\_\_], dressed to size indicated and with outer edges beveled.

#### 2.1.13 Catwalks

Boards, [1 by 6 inches nominal](#), species and grade equal to or exceeding 3 Common Hem-Fir under [WWPA G-5](#).

#### 2.1.14 Siding

Provide hardboard, plywood, or wood for horizontal siding. Provide hardboard or plywood for panel siding. [ Provide [certified sustainably harvested siding.](#)] [ When located on the interior of buildings, provide products with no added urea-formaldehyde resins. Provide data identifying [VOC content for siding.](#)]

##### 2.1.14.1 Horizontal Hardboard Siding

[AHA A135.6](#), factory primed face and longitudinal edges, factory sealed back, lap type, [8] [9] [10] [12] inches wide, maximum practicable lengths, [3/8 or 7/16 inch](#) thick, [smooth] [embossed] [textured] face.

##### 2.1.14.2 Panel Hardboard Siding

APA A135.6, factory primed face and longitudinal edges, factory sealed back, 4 feet wide, maximum practicable lengths, 3/8 or 7/16 inch thick, [smooth] [embossed] face [, and grooved as selected from manufacturer's standard patterns].

#### 2.1.14.3 Horizontal Plywood Siding

APA L870, exterior, [medium density overlay] lap type, [6] [8] [12] inches wide, maximum practicable lengths, [3/8] [7/16] [15/32] [1/2] inch thick, [smooth] [embossed] [rough sawn texture] [embossed] face.

#### 2.1.14.4 Panel Plywood Siding

APA L870, exterior, [medium density overlay,] 4 feet wide, maximum practicable lengths, span rating of [16] [24] inches on center, [smooth] [embossed] [rough sawn texture] [striated] face, [and grooved] as selected from manufacturer's standard patterns.

#### 2.1.14.5 Horizontal Rated Siding

Qualified under APA E445, exterior type [medium density overlay], lap types, [6] [8] [10] [12] inches wide, maximum practicable lengths, [7/16] [15/32] [1/2] inch thick, [smooth] [embossed] [rough sawn texture] face.

#### 2.1.14.6 Panel Rated Siding

Qualified under APA E445, exterior type, [medium density overlay] 4 feet wide, maximum practicable lengths, [span rated at 16 inch] [span rated at 24 inch,] [smooth] [embossed] [striated] face [, and grooves] as selected from manufacturer's standard patterns.

#### 2.1.14.7 Wood Siding

Provide [horizontal bevel type, minimum 3/16 inch thin edge by minimum 7/16 inch thick edge,] [horizontal plain lap type] [horizontal drop type] [vertical board, tongue and groove or shiplap on long edges,] [vertical board and batten type,] 1 inch thick, [6] [8] [10] inches wide, maximum practicable lengths, [smooth] [rough sawn texture].

#### 2.1.14.8 Engineered Wood Structural Panels

Comply with ICC IBC, Chapter 23 Wood, and with APA S350, exterior, exposure [1] [2], [single-faced] [double-faced], 4 feet wide, maximum practicable lengths, selected from manufacturer's standard patterns to satisfy the wind load for the specified span.

#### 2.1.14.9 Epoxy Coated Wood Panels

Provide prefinished epoxy coated wood panels consisting of an asbestos-free cement board base sheet with a factory applied surface of epoxy resin and decorative natural stone chips. Provide factory applied finish in a minimum 20 mils thickness consisting of 100 percent solids, with a two component epoxy resin based coating followed by an application of inert aggregate. Provide stone color(s) and accessory colors as selected by Contracting Officer's Representative from manufacturer's full color and pattern ranges. Provide cement board base sheets in a minimum thickness of 1/4 inch thick. Dimensionally stable finished panels are required. Water absorption on the surfaced side of panels cannot exceed 0.20 percent after

24 hours of submergence in water. Provide accessories in manufacturer's standard extruded aluminum. Provide mouldings for meeting strips, end caps, inside corners, outside corners. Provide non-corrosive, self-tapping screw type fasteners finished to match the color of the panel surface. Provide caulking compounds that are color compatible, low modulus silicone or urethane types.

## 2.2 SOFFITS

### 2.2.1 Hardboard and Plywood

Provide hardboard and plywood soffits in siding grade hardboard,  $3/8$  or  $7/16$  inch thick; plywood, APA L870, exterior type, [Grade A-C] [plywood panel siding] [rated siding], [ $11/32$  inch thick for 24 inches on center] [ $15/32$  inch thick for 32 inches on center] [ $19/32$  inches thick for 48 inches on center] maximum span with all edges supported.

## 2.3 FASCIAS AND TRIM

### 2.3.1 Wood

Provide species and grades for all fascia and trim, including exterior door and window casings, in accordance with AWWPA U1 Use Category System Tables. Provide sizes indicated. Metal corners may be provided in lieu of wood corner boards for horizontal siding. If metal corners are used, provide galvanized steel or aluminum, completely coated with primer compatible for the specific metal substrate.

## 2.4 COUNTERTOPS

### 2.4.1 Laminated Plastic-faced Countertops

ANSI/NEMA LD 3.

#### 2.4.1.1 Countertop Finishes

High pressure plastic laminate, Grade GP 50 or PF 42, satin or textured finish. Provide color and pattern [\_\_\_\_\_] [as selected by Contracting Officer's Representative from manufacturer's full color and pattern ranges].

#### 2.4.1.2 Backing Sheet

Heavy gauge, BK 20.

### 2.4.2 Solid Surface

For solid surface countertops refer to Section 06 61 16, SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

## 2.5 MOISTURE CONTENT OF WOOD PRODUCTS

Air dry or kiln dry lumber. Kiln dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the jobsite, and when installed, must be as follows:

- a. Interior Paneling: [6] [12] percent.
- b. Interior Finish Lumber, Trim, and Millwork:  $1-1/4$  Inches Nominal or Less in Thickness: [6] [12] percent on 85 percent of the pieces and

[8] [15] percent on remainder.

- c. Exterior Treated and Untreated Finish Lumber and Trim: 4 inches Nominal or Less in Thickness: 19 percent.
- d. Exterior Wood Siding: 15 percent.
- e. Provide moisture content of other materials in accordance with the applicable standards.

## 2.6 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

### 2.6.1 Non-Pressure Treatment

Treat woodwork and millwork, such as [cabinets, ]exterior trim, door trim, and window trim, in accordance with [WDMA I.S.4](#), with either 2 percent copper naphthenate, 3 percent zinc naphthenate, or 1.8 percent copper-8-quinolinolate. Provide a liberal brush coat of preservative treatment to field cuts and holes.

### 2.6.2 Pressure Treatment

Treat lumber and plywood used on the exterior of buildings [or in contact with masonry or concrete] with a waterborne preservative listed in [AWPA U1](#) (P series is included therein by reference) as applicable, and inspected in accordance with [AWPA U1](#). Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Provide treated plywood to a reflection level as follows:

Preservative treat exterior wood moulding and millwork that will be within [18 inches](#) of soil or in contact with water or concrete in accordance with [WMPA WM 6](#). Provide a field treatment in accordance with [AWPA M4](#) of exposed areas of treated wood that have been cut or drilled. Items of all-heart material of cedar, cypress, or redwood do not require preservative treatment except when in direct contact with soil.

## 2.7 FIRE-RETARDANT TREATMENT

### 2.7.1 Wood Products

Pressure treat fire-retardant treated lumber and plywood in accordance with [AWPA U1](#). Comply with material use as defined in [AWPA U1](#) for Interior Type [A] [and] [B] and Exterior Type. Treatment and performance inspection must be conducted by a qualified independent testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance with such rating. Subject treated materials that will be exposed to rain wetting to an accelerated weathering technique in accordance with [ASTM D2898](#), Method A, prior to being tested for compliance with [AWPA U1](#).

Treat the following items:

[\_\_\_\_\_].

## 2.8 [HARDWARE AND ACCESSORIES](#)

Provide sizes, types, and spacings of hardware and accessories as recommended in writing by the wood product manufacturer, except as



otherwise specified.

#### 2.8.1 Wood Screws

ASME B18.6.1.

#### 2.8.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

#### 2.8.3 Nails

Use nails of a size and type best suited for each application and in accordance with ASTM F547. Use hot-dipped galvanized or aluminum nails for exterior applications. For siding, provide nails of sufficient length to extend 1-1/2 inches into supports, including wood sheathing over framing. Where nailing is impractical, provide screws of a size and type best suited for each application.

#### 2.8.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type [\_\_\_\_], with shelf rests Type [\_\_\_\_].

#### 2.8.5 Vertical Slotted Shelf Standards

ANSI/BHMA A156.9, Type [\_\_\_\_], with shelf brackets Type [\_\_\_\_].

#### 2.8.6 Closet Hanger Rods

Chromium plated steel rods, not less than 1 inch diameter by 18 gage. Rods may be adjustable with integral mounting brackets if smaller tube is 1 inch by 18 gage. Provide intermediate support brackets for rods more than 48 inches long.

### 2.9 FABRICATION

#### 2.9.1 Quality Standards (QS)

##### 2.9.1.1 Grades

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in NAAWS 3.1. Provide items not otherwise specified in a specific grade as "Custom" grade.

##### 2.9.1.2 Adhesives

Select adhesives for durability and permanent bonding. Address factors such as materials that must be bonded, expansion and contraction, bond strength, fire rating, moisture resistance, and manufacturer's recommendations.

[ Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or

validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building.

### ]2.9.2 Countertops

Fabricate with lumber and a core of [exterior plywood] [or] [particleboard], glued and screwed to form an integral unit. Bond laminated plastic under pressure to exposed surfaces, using adhesive as recommended by the plastic manufacturer [, and bond a backing sheet under pressure to underside of countertop]. Provide countertop units as post-formed type, no-drip nose, cove mouldings, Style A backsplash, and surfaced with ANSI/NEMA LD 3, Grade PF 42 plastic. Provide backsplashes not less than 3-1/2 inches nor more than 4-1/2 inches high.

### 2.9.3 Cabinets

Unless specified otherwise, provide wall and base cabinets of the same construction, materials, and finishes as countertops. Fabricate cabinets with solid ends and frame fronts, or with frames all around. Provide frames of solid hardwood not less than 3/4 by 1-1/2 inches. Provide ends, bottoms, backs, partitions, and doors as hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Provide cabinet doors, frames, and solid exposed ends 3/4 inch thick minimum. Provide cabinet bottoms, partitions, and framed ends to be 1/2 inch minimum. Provide shelves to be 5/8 inch thick minimum. Provide cabinet backs 1/4 inch thick minimum.

#### 2.9.3.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide cabinet hardware including two self, closing hinges for each door, two side mounted metal drawer slides for each drawer, and pulls for all doors and drawers as follows. Provide hardware exposed to view [as bright chromium plated] [\_\_\_\_\_]. Comply with the following requirements for all cabinet hardware:

- a. Provide frameless concealed European style, back mounted hinges with 165 degree opening and a self closing feature when at less than 90 degrees open.
- b. Provide drawer slides having a static rating capacity of [100 lbs. ] [\_\_\_\_\_]. Slides to have a self closing/stay closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.
- c. Provide drawer pulls as [wire type pulls with center-to-center dimension of not less than 3-1/2 inches and a cross sectional diameter of 5/16 inch]. Provide handle projections not less than [ 1-5/16 inches ]. [\_\_\_\_\_].
- d. Provide heavy duty magnetic drawer catches.

#### 2.9.3.2 Finish

Provide a clear factory finish on wood surfaces after fabrication. Provide fabricator's standard natural finish equivalent to one coat of sealer, one coat of varnish on all surfaces and a second coat of varnish on surfaces

exposed to view. Provide spar varnish in exterior or wet area applications. Sand lightly and wipe clean between coats.

#### 2.9.4 Workbenches

Dovetail and glue drawer corners. Fasten frames with suitable wood screws or bolts. Sand exposed surfaces smooth, and ease exposed edges. Provide two side mounted, metal, ball bearing drawer slides [ANSI/BHMA A156.9, Type [\_\_\_\_],] for each drawer, and at least two surface mounted hinges[, Type [\_\_\_\_],] and a magnetic catch[, Type [\_\_\_\_],] for each door.

#### 2.9.5 Casework with Transparent Finish (CTF)

##### 2.9.5.1 AWI Quality Grade

[Premium] [Custom] [Economy] grade.

##### 2.9.5.2 Construction

Provide [reveal overlay] [flush overlay] [exposed face frame] design details.

##### 2.9.5.3 Exposed Parts

[\_\_\_\_] specie, [\_\_\_\_] cut.

##### 2.9.5.4 Semi-Exposed Parts

As specified in the [NAAWS 3.1](#) for the grade selected.

#### 2.9.6 Casework with High Pressure Laminate Finish

##### 2.9.6.1 AWI Quality Grade

[Premium] [Custom] grade.

##### 2.9.6.2 Construction

Provide [reveal overlay] [flush overlay] [exposed face frame] design details.

##### 2.9.6.3 Exposed Surfaces

High pressure plastic laminate, color and pattern [\_\_\_\_] [as selected by Contracting Officer's Representative from manufacturer's full range].

##### 2.9.6.4 Semi-Exposed Surfaces

As specified in the [NAAWS 3.1](#) for the grade selected.

##### [2.9.6.5 Edge Banding

Provide edge banding for casework doors and drawer fronts in PVC vinyl [0.020 inch] [0.125 inch] [\_\_\_\_] thick. Provide width [15/16 inches] [\_\_\_\_]. [ Match color and pattern to exposed door and drawer front laminate pattern and color.] [ Provide color and pattern [\_\_\_\_].]

#### ]PART 3 EXECUTION

Do not install building construction materials that show visual evidence of biological growth.

### 3.1 FINISH WORK

Apply primer to finish work before installing. Where practicable, shop assemble and finish millwork items. Construct joints tight and in a manner to conceal shrinkage but to avoid cupping, twisting and warping after installation. Miter trim and mouldings at exterior angles; cope at interior angles and at returns. Provide millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

#### 3.1.1 Exterior Finish Work

Machine sand exposed flat members and square edges. Machine finish semi-exposed surfaces. Construct joints to exclude water. In addition to nailing, glue joints with waterproof glue as necessary for weather resistant construction. Evenly distribute end joints in built-up members. Provide shoulder joints in flat work. Reinforce backs of wide-faced miters with metal rings and waterproof glue. Unless otherwise indicated, provide fascia and other flat members  $3/4$  inch thick minimum. Provide door and window trim in single lengths. Provide braced, blocked, and rigidly anchored cornices for support and protection of vertical joints. Provide soffits in largest practical size. Align joints of plywood over centerlines of supports. Fasten soffits with aluminum or stainless steel nails. Back prime all concealed surfaces of exterior trim.

#### 3.1.2 Interior Finish Work

After installation, sand exposed surfaces smooth. Provide window and door trim in single lengths.

#### 3.1.3 Door Frames

Set plumb and square. Provide solid blocking at not more than 16 inches on center for each jamb. Position blocking to occur behind hinges and lock strikes. Double wedge frames and fasten with finish nails. Set nails for putty stopping.

#### 3.1.4 Thresholds

Unless otherwise indicated, provide thresholds [ $5/8$  inch thick by  $2-5/8$  inches wide with beveled sides] and cut to fit at jambs. Fasten thresholds with casing nails. Set nails for putty stopping.

#### 3.1.5 Window Stools and Aprons

Provide stools with rabbets over window sills. Provide aprons with returns cut accurately to profile of member.

#### 3.1.6 Bases

Provide flat member with a moulded top [and oak shoe mould]. Fasten base to framing or to grounds. [ Nail shoe mould to base.] Set [shoe mould] [one-piece wood base] after finish flooring is in place.

#### 3.1.7 Finish Stair Work

Fit, nail, screw, bolt, and glue stair work together to form a strong, rigid structure without squeaks or vibrations. Anchor newels and posts securely to stair framing. Cut newels, posts, and drops accurately around floor construction to make a tight fit. Embed balusters into treads and landings and secure with glue. Provide railings with straight runs that follow the slope of the stairs and have smooth curved turns. Return railing profile at ends and secure joints with bolts and nuts in accordance with structural load requirements for railings. Secure railing to posts and newels with concealed anchors. Support wall rails on metal brackets spaced near ends and at not more than 5 feet on center.

### 3.2 SHELVING

Support 1 inch nominal thick wood shelf material or 3/4 or 23/32 inch thick plywood shelf material with end and intermediate supports arranged to prevent buckling and sagging. [ Provide hook strips 1 by 4 inches nominal and cleats 1 by 2 inches nominal.] Provide cleats except where hook strips are specified or indicated. [ Where adjustable shelving is indicated, provide standards and brackets or shelf rests for each shelf.] [ Anchor standards to wall at not more than 2 feet on center.]

#### 3.2.1 Linen Closets

Unless indicated otherwise, provide linen closets with a counter shelf 20 inches wide located 36 inches above the floor, a lower shelf approximately 18 inches wide and 18 inches above the floor, and three upper shelves 11-1/4 inches wide located 14 inches above the counter shelf and 14 inches apart.

#### 3.2.2 Storage Rooms

Unless otherwise indicated, provide storage rooms with shelves 11-1/4 inches wide, bottom shelf 18 inches above the floor, top shelf 18 inches below the ceiling, and intermediate shelves approximately 18 inches apart.

#### 3.2.3 Room Closets

Provide two shelves 11-1/4 inches wide. Support lower shelf by hook strips at back and ends, and provide full length wood or metal clothes hanger rods unless indicated otherwise.

#### 3.2.4 Cleaning Gear Closets

Provide [shelves of size and arrangement indicated] [two shelves 14 inches wide].

### 3.3 CLOTHES HANGER RODS

Provide clothes hanger rods where indicated and in closets having hook strips. Set rods parallel with front edges of shelves and support by sockets at each end and intermediate brackets spaced not more than 4 feet on center.

### 3.4 MISCELLANEOUS

#### 3.4.1 Countertops

Conceal fastenings where practicable. Fit counters tight to adjoining surfaces and scribe where necessary. Provide scribed joints neat and

flush. Provide counter sections in longest lengths practicable with a minimum number of joints. Where joints are necessary, provide tight joints drawn up with concealed type heavy pull-up bolts. Glue joints with water resistant glue and make rigid with screws, bolts, or other approved fastenings.

#### 3.4.2 Cabinets

Provide cabinets level, plumb, true, and tight to adjacent walls. Secure cabinets to walls with concealed toggle bolts. Secure top to cabinet with concealed screws. [ Make cutouts for fixtures from templates supplied by fixture manufacturer. Locate cutouts for pipes so that edges of holes are covered by escutcheons after installation.]

#### 3.4.3 Workbenches

Provide level, plumb, and tight to adjacent construction. Fasten workbenches to walls with screws or toggle bolts and to floors with expansion bolts.

#### 3.4.4 Wood Seats

Support seats [on brackets spiked to the studs] [on stanchions]. Secure seats to supports with [screws] [bolts] as required; countersink heads of [screws] [bolts] and fill holes with hardwood filler, finished flush with tops of seats.

#### 3.4.5 Wood Bumpers

Bore, countersink, and bolt wood bumpers in place where indicated.

#### 3.4.6 Catwalks in Attic Spaces

Lay boards with 1 inch spaces between. Stagger end joints, with each joint on a support.

### 3.5 SIDING

#### 3.5.1 Installation of Siding

Fit and position siding without springing or otherwise forcing panels into place. [ For siding to have a stain finish, set nails and stop with nonstaining putty to match finished siding. ] [ For siding to have a paint finish, drive nails flush. ]

#### 3.5.2 Horizontal Siding

Locate end joints over framing members and alternate such that there are a minimum of two boards between joints on the same support. Evenly distribute shorter pieces throughout the installation. Provide starter strips to establish proper cant for siding. Predrill ends of siding as necessary to prevent splitting when nailed. [ Horizontal bevel or plain lap siding: Overlap and nail into each support in accordance with recommendations of siding manufacturer. ] [ Horizontal drop siding: Work each course into top edge of previous course. Nail into each support with [two nails, one near lower edge to clear top of previous course, and one just above mid-height of course. ] [one nail just above mid-height of course. ] ]

### 3.5.3 Vertical Board Siding

Apply siding with horizontal joints only at locations indicated. Work each board into edge of previous course. Nail into supports at 24 inches on center with [two nails, one blind if possible at or near joint with previous board, and one just outside board centerline.] [one nail just outside board center line.]

### 3.5.4 Vertical Board and Batten Siding

Apply with horizontal joints only at locations indicated. Install each board with 1/2 inch of space between boards. Nail at center of board and into supports at 24 inches on center. Center battens over space between boards and nail down center at 16 inches on center.

### 3.5.5 Panel Siding

Apply panels with edges at joints spaced in accordance with manufacturer's recommendations. Provide shiplapped edges or square edges that will be covered by battens in a [primed for paint finish,] [sealed for stain finish]. Back all edges with framing members. Nail panels at edges 6 inches on center and at intermediate supports 12 inches on center. Locate edge nailing 3/8 inch from edges. For shiplap joints, nail 3/8 inch from visible joint and at a location to penetrate lap with previous panel. When panel siding is part of an engineered shear wall or used as wall bracing, nail shiplap joints to supports with double rows of nails. Space battens at [12] [16] inches on center and nail down center at 24 inches on center.

### 3.5.6 Epoxy Coated Panels

Provide panels where indicated and install in accordance with panel manufacturer's written installation instructions.

## 3.6 SOFFITS

### 3.6.1 Wood

Provide panels with edges at joints spaced in accordance with manufacturer's written instructions and with all edges backed by framing members. Nail panels 3/8 inch from edges at 6 inches on center and at intermediate supports at 12 inches on center. Provide panels in maximum practicable lengths.

## 3.7 FASCIA AND EXTERIOR TRIM

Construct, caulk, and machine sand exposed surfaces and edges to exclude water. In addition to nailing, glue joints as necessary for weather resistance. Evenly distribute end joints in built-up members. Shoulder joints in flat work. Reinforce backs of wide-faced miters with metal rings and glue. Provide fascia and other flat members in maximum practicable lengths. Braced, block, and rigidly anchor cornices for support and protection of vertical joints.

## 3.8 MOULDING AND INTERIOR TRIM

Install mouldings and interior trim straight, plumb, level and with closely fitted joints. Provide exposed surfaces machine sanded at the shop. Cope returns and interior angles at moulded items and miter external corners. Shoulder intersections of flatwork to ease any inherent changes in plane.

Provide window and door trim in single lengths. Blind nail to the extent practicable. Set and stop face nailing with a nonstaining putty to match the applied finish. Use screws for attachment to metal; set and stop screws in accordance with the same quality requirements for nails.

-- End of Section --



## SECTION 06 41 16.00 10

## PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

08/10, CHG 1: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2 (1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure

## ASTM INTERNATIONAL (ASTM)

ASTM D1037 (2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM F547 (2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2020) Cabinet Hardware

## COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

CPA A208.2 (2016) Medium Density Fiberboard (MDF) for Interior Applications

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure Decorative Laminates

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

## U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)

## UL ENVIRONMENT (ULE)

## ULE Greenguard

UL Greenguard Certification Program

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

## ANSI/WDMA I.S.1A

(2013) Interior Architectural Wood Flush Doors

WOODWORK INSTITUTE (WI)

## NAAWS 3.1

(2017; 2018 Errata Edition) North American Architectural Woodwork Standards

## 1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework [cabinets] [vanities] [\_\_\_\_\_] as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Sand smooth and apply a clear finish of polyurethane to all exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

## 1.3 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for project LEED BD+C [local/regional materials,] [low-emitting materials,] [recycled content,] [certified wood] [\_\_\_\_\_] [and] [rapidly renewable materials] LEED documentation requirements.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Shop Drawings  
Installation

## SD-03 Product Data

Wood Materials  
Wood Finishes  
Finish Schedule  
Certification

## SD-04 Samples

Plastic Laminates  
Cabinet Hardware

## SD-07 Certificates

Quality Assurance  
Laminate Clad Casework

## SD-11 Closeout Submittals

LEED Documentation

## 1.5 QUALITY ASSURANCE

## 1.5.1 General Requirements

Unless otherwise noted on the drawings, furnish all materials, construction methods, and fabrication conforming to and complying with the [premium] [custom] grade quality standards as outlined in **NAAWS 3.1**, Section for laminate clad cabinets. These standards apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work must be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of **NAAWS 3.1** requirements, in general, and the specific **NAAWS 3.1** requirements provided in this specification. The quality control statement must also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. Provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity in the quality control statement.

## 1.5.2 Mock-ups

Prior to final approval of **shop drawings**, provide a full-size mock-up of a typical [vanity] [floor cabinet] [wall cabinet] [\_\_\_\_\_], including all components and hardware necessary to illustrate a completed unit with a minimum of one door and one drawer assembly. Include countertops and back splashes where specified. Utilize specified finishes in the patterns and colors [as indicated] [as indicated in Section 09 06 00 SCHEDULES FOR FINISHES]. Upon disapproval, rework or remake the mock-up until approval is secured. Remove rejected units from the jobsite. Approved mock-up may remain as part of the finished work. Submit shop drawings showing all fabricated casework items in plan view, elevations and cross-sections to accurately indicate materials used, details of construction, dimensions, methods of fastening and erection, and installation methods proposed. Clearly cross-reference shop drawing casework items to casework items located on the project drawings. Shop drawings will include a color schedule of all casework items to include all countertop, exposed, and semi-exposed cabinet finishes to include finish material manufacturer, pattern, and color.

1.5.3 Sustainable Design **Certification**

Product must be third party certified in accordance with **ULE Greenguard** [Gold], **SCS Scientific Certification Systems Indoor Advantage** [Gold] or equal. Perform certification annually and keep current.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units

to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. Ventilate the storage area and do not subject to extreme changes in temperature or humidity.

## 1.7 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Do not install units in any room or space until painting, and ceiling installation are complete within the room where the units are located. Install floor cabinets before finished flooring materials are installed.

## PART 2 PRODUCTS

### 2.1 WOOD MATERIALS

#### 2.1.1 Lumber

- a. Provide kiln-dried Grade III framing lumber to dimensions as shown on the drawings. Frame front, where indicated on the drawings, must be nominal 3/4 inch hardwood.
- b. Standing or running trim casework components, which are specified to receive a transparent finish, must be [\_\_\_\_\_] hardwood species, plain sawn. AWI grade must be [premium] [custom]. Indicate location, shape, and dimensions on the drawings.

#### 2.1.2 Panel Products

##### 2.1.2.1 Plywood

Use veneer core hardwood plywood, [NAAWS 3.1](#) Grade AA panels for framing purposes. Indicate nominal thickness of plywood panels in this specification and on the drawings.

##### 2.1.2.2 Particleboard

Provide industrial grade, medium density ( 40 to 50 pounds per cubic foot), 3/4 inch thick particleboard. Use a moisture-resistant particleboard in grade Type 2-M-2 or 2-M-3 as the substrate for plastic laminate covered [countertops] [backsplashes] [\_\_\_\_\_] [components as located on the drawings] and other areas subjected to moisture. Provide particleboard meeting the minimum standards listed in [ASTM D1037](#) and [CPA A208.1](#).

##### 2.1.2.3 Medium Density Fiberboard

Medium density fiberboard (MDF) must be an acceptable panel substrate where noted on the drawings. Provide medium density fiberboard meeting the minimum standards listed in [CPA A208.2](#).

### 2.2 SOLID POLYMER MATERIAL

Provide solid surfacing casework components in conformance to the requirements of Section [06 61 16](#) SOLID SURFACING FABRICATIONS.

### 2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

Provide [plastic laminates](#) meeting the requirements of [ANSI/NEMA LD 3](#) and [ANSI A161.2](#) for high-pressure decorative laminates. Indicate design, colors, surface finish and texture, and locations on [the drawings]

[Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_]. Submit two samples of each plastic laminate pattern and color. Samples less than 5 by 7 inches in size are not acceptable. Provide plastic laminate types and nominal minimum thicknesses for casework components as indicated in the following paragraphs.

#### 2.3.1 Horizontal General Purpose Standard (HGS) Grade

Provide horizontal general purpose standard grade plastic laminate that is 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

#### 2.3.2 Vertical General Purpose Standard (VGS) Grade

Provide vertical general purpose standard grade plastic laminate that is 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

#### 2.3.3 Horizontal General Purpose Postformable (HGP) Grade

Provide horizontal general purpose postformable grade plastic laminate that is 0.042 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

#### 2.3.4 Vertical General Purpose Postformable (VGP) Grade

Provide vertical general purpose postformable grade plastic laminate that is 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of components where postforming is required for curved surfaces.

#### 2.3.5 Horizontal General Purpose Fire Rated (HGF) Grade

Provide horizontal general purpose fire rated grade plastic laminate that is 0.048 inches (plus or minus 0.005 inches) in thickness and a class 1, class A fire rating in accordance with ASTM E84.

#### 2.3.6 Vertical General Purpose Fire Rated (VGF) Grade

Provide vertical general purpose fire rated grade plastic laminate that is 0.028 inches (plus or minus 0.004 inches) in thickness and a class 1, class A fire rating in accordance with ASTM E84.

#### 2.3.7 Cabinet Liner Standard (CLS) Grade

Provide cabinet liner standard grade plastic laminate that is 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

#### 2.3.8 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness must be 0.020 inches. Provide backing sheets for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

## 2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Use thermoset decorative overlays (melamine panels) for [casework cabinet interior] [drawer interior] [all semi-exposed] [\_\_\_\_\_] surfaces.

## 2.5 EDGE BANDING

Provide PVC vinyl, [ 0.020 inch] [ 0.125 inch] [\_\_\_\_\_] thick, edge banding for casework doors and drawer fronts. Material width must be [ 15/16 inches ] [as indicated on the drawings] [\_\_\_\_\_]. Color and pattern must [match exposed door and drawer front laminate pattern and color] [be as indicated on the drawings] [\_\_\_\_\_].

## 2.6 VINYL COUNTERTOP EDGE

Where located on the drawings, use a tee-mould anchor type with a [flat] [radiused] [\_\_\_\_\_] edge profile vinyl edging for countertops. Finished width must be [as indicated on the drawings] [\_\_\_\_\_]. Indicate color on [the drawings] [Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_].

## 2.7 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include [hinges], [pulls], [drawer glides], and [\_\_\_\_\_]. Provide hardware conforming to ANSI/BHMA A156.9, unless otherwise noted, and consisting of the following components:

### 2.7.1 Door Hinges

[\_\_\_\_\_] type, BHMA No. [\_\_\_\_\_].

### 2.7.2 Cabinet Pulls

[\_\_\_\_\_] type, BHMA No. [\_\_\_\_\_].

### 2.7.3 Drawer Slide

Side mounted [\_\_\_\_\_] type, BHMA No. [\_\_\_\_\_] with [full] [\_\_\_\_\_] extension and a minimum [ 75 pound] [ 100 pound] [\_\_\_\_\_] load capacity. Include an [integral] [positive] stop to avoid accidental drawer removal.

### 2.7.4 Adjustable Shelf Support System

[Recessed (mortised) metal standards, BHMA No. B04071, finish: [\_\_\_\_\_]. Support clips for the standards must be [open type, BHMA No. B04091] [closed type, BHMA No. B04081], finish: [\_\_\_\_\_]] [Multiple holes with [metal] [plastic] [wood] pin supports].

## 2.8 FASTENERS

Provide nails, screws, and other suitable fasteners that are the size and type best suited for the purpose and conforming to ASTM F547 where applicable.

## 2.9 ADHESIVES, CAULKS, AND SEALANTS

### 2.9.1 Adhesives

Use formula and type of adhesives recommended by AWI. Select adhesives for

their ability to provide a durable, permanent bond and take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Meet local regulations regarding VOC emissions and off-gassing.

#### 2.9.1.1 Wood Joinery

Use Type II for interior use [urea-formaldehyde resin formula] [polyvinyl acetate resin emulsion] [\_\_\_\_\_] adhesives to bond wood members. Adhesives must withstand a bond test as described in ANSI/WDMA I.S.1A.

#### 2.9.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood must be [a water-based contact adhesive] [\_\_\_\_\_] [adhesive consistent with AWI and laminate manufacturer's recommendations]. Adhere PVC edgbanding using a polymer-based hot melt glue.

#### 2.9.2 Caulk

Use clear, 100 percent silicone caulk to fill voids and joints between laminated components and between laminated components and adjacent surfaces.

#### 2.9.3 Sealant

Use sealant recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

### 2.10 WOOD FINISHES

Paint, stain, varnish and perform applications required for laminate clad casework components [\_\_\_\_\_] [as indicated in Section 09 90 00 PAINTS AND COATINGS] [as indicated in Section 09 06 00 SCHEDULES FOR FINISHES]. Indicate color and location on the drawings.

### 2.11 ACCESSORIES

#### 2.11.1 Glass and Glazing

Reference glass required in laminated casework by type in accordance with Section 08 81 00 GLAZING. Glass must be one of the following:

- a. Type [A] [\_\_\_\_\_].
- b. [Float] [Patterned] glass: [Clear] [pattern] quality.
- c. Safety glass: [Clear] [\_\_\_\_\_]; [heat strengthened] [fully tempered] [laminated] [\_\_\_\_\_]; [\_\_\_\_\_] inches thick minimum.
- d. Wire Glass: [Clear] [\_\_\_\_\_], polished [both sides] [one side]; [square] [diagonal] [\_\_\_\_\_] mesh woven stainless steel wire of grid [\_\_\_\_\_] inches size; [\_\_\_\_\_] inches thick.

#### 2.11.2 Grommets

Use [plastic] [metal] [rubber] [\_\_\_\_\_] material for cutouts with a diameter of [\_\_\_\_\_] inches. Indicate locations on the drawings.

## 2.12 FABRICATION

Verify field measurements as indicated in the [shop drawings](#) before fabrication. Accomplish fabrication and assembly of components at the shop site to the maximum extent possible. Meet or exceed the requirements for AWI [premium] [custom] grade unless otherwise indicated in this specification. Make cabinet style, in accordance with [NAAWS 3.1](#), Section 400-G descriptions, [flush overlay] [reveal overlay] [flush inset without face frame] [flush inset with face frame] [as indicated on the drawings].

### 2.12.1 Base and Wall Cabinet Case Body

#### 2.12.1.1 Cabinet Components

Use frame members that are glued-together, kiln-dried hardwood lumber. Brace top corners, bottom corners, and cabinet bottoms with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Construct cabinet components from the following materials and thicknesses:

##### 2.12.1.1.1 Body Members (Ends, Divisions, Bottoms, and Tops)

[3/4 inch](#) [particleboard] [medium density fiberboard (MDF)] [veneer core plywood] panel product

##### 2.12.1.1.2 Face Frames and Rails

[3/4 inch](#) [hardwood lumber] [panel product]

##### 2.12.1.1.3 Shelving

[3/4 inch](#) [particleboard] [medium density fiberboard (MDF)] [veneer core plywood] panel product

##### 2.12.1.1.4 Cabinet Backs

[1/4 inch](#) [particleboard] [medium density fiberboard (MDF)] [veneer core plywood] panel product

##### 2.12.1.1.5 Drawer Sides, Backs, and Subfronts

[1/2 inch](#) [hardwood lumber] [panel product]

##### 2.12.1.1.6 Drawer Bottoms

[1/4 inch](#) [particleboard] [medium density fiberboard (MDF)] [veneer core plywood] panel product

##### 2.12.1.1.7 Door and Drawer Fronts

[3/4-inch](#) [particleboard] [medium density fiberboard (MDF)] panel product

#### 2.12.1.2 Joinery Method for Case Body Members

##### 2.12.1.2.1 Tops, Exposed Ends, and Bottoms

- a. Steel "European" assembly screws ( [1-1/2 inch](#) from end, [5 inch](#) on center, fasteners will not be visible on exposed parts).



- b. Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).
- c. Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).
- d. Spline or biscuit, glued under pressure.

#### 2.12.1.2.2 Exposed End Corner and Face Frame Attachment

##### 2.12.1.2.2.1 Mitered Joint

lock miter or spline or biscuit, glued under pressure (no visible fasteners)

##### 2.12.1.2.2.2 Non-Mitered Joint (90 degree)

butt joint glued under pressure (no visible fasteners)

##### 2.12.1.2.2.3 Butt Joint

glued and nailed

#### 2.12.1.2.3 Cabinet Backs (Wall Hung Cabinets)

Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Use the following fabrication method:

##### 2.12.1.2.3.1 Full Bound

Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets must be side bound, captured in grooves; glued and fastened to top and bottom.

##### 2.12.1.2.3.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Do not expose edge of back on finished sides. Anchor strips are not required when so attached.

##### 2.12.1.2.3.3 Side Bound

Side bound, captured in groove or rabbetts; glued and fastened.

#### 2.12.1.2.4 Cabinet Backs (Floor Standing Cabinets)

##### 2.12.1.2.4.1 Side Bound

Side bound, captured in grooves; glued and fastened to top and bottom.

##### 2.12.1.2.4.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Do not expose edge of back on finished sides. Anchor strips are not required when so attached.

##### 2.12.1.2.4.3 Side Bound with Rabbetts

Side bound, placed in rabbetts; glued and fastened in rabbetts.

#### 2.12.1.2.5 Wall Anchor Strips

Wall Anchor Strips are required for all cabinets with backs less than  $1/2$  inch thick. Use strips consisting of minimum  $1/2$  inch thick lumber, minimum  $2-1/2$  inches width; securely attach to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

#### 2.12.2 Cabinet Floor Base

Mount floor cabinets on a base constructed of [nominal  $2$  inch thick lumber] [ $3/4$  inch particleboard] [ $3/4$  inch fiberboard] [ $3/4$  inch veneer core exterior plywood]. Provide base assembly components that are [treated lumber] [a moisture-resistant panel product]. Make finished height for each cabinet base [no less than the full height of the installed, specified wall base] [as indicated on the drawings]. Make bottom edge of the cabinet door or drawer face [flush with top of base] [extend below the top of the base as indicated on the drawings].

#### 2.12.3 Cabinet Door and Drawer Fronts

Fabricate door and drawer fronts from [ $3/4$  inch medium density particleboard] [ $3/4$  inch medium density fiberboard (MDF)]. Surface all door and drawer front edges with [high pressure plastic laminate] [PVC edgebanding], color and pattern [to match exterior face laminate] [as indicated on the drawings] [as indicated in Section 09 06 00 SCHEDULES FOR FINISHES].

#### 2.12.4 Drawer Assembly

##### 2.12.4.1 Drawer Components

Provide drawer components consisting of a removable drawer front, sides, backs, and bottom. Construct drawer components of the following materials and thicknesses:

##### 2.12.4.1.1 Drawer Sides and Backs For Transparent Finish

$1/2$  inch thick [solid hardwood lumber] [7-ply hardwood veneer core plywood (no voids), any species]

##### 2.12.4.1.2 Drawer Sides and Backs For Laminate Finish

$1/2$  inch thick 7-ply hardwood veneer core substrate

##### 2.12.4.1.3 Drawer Sides and Back For Thermoset Decorative Overlay (Melamine) Finish

$1/2$  inch thick medium density particleboard or MDF fiberboard substrate

##### 2.12.4.1.4 Drawer Bottom

$1/4$  inch thick [veneer core panel product for transparent or plastic laminate finish] [thermoset decorative overlay melamine panel product]

##### 2.12.4.2 Drawer Assembly Joinery Method

- a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.
- b. Doweled, glued under pressure.
- c. Lock shoulder, glued and pin nailed.
- d. Set bottoms into sides, front, and back, 1/4 inch deep groove with a minimum 3/8 inch standing shoulder.

## 2.12.5 Shelving

### 2.12.5.1 General Requirements

Fabricate shelving from [ 3/4 inch medium density particleboard] [ 3/4 inch medium density fiberboard (MDF)] [ 3/4 inch veneer core plywood]. Finish all shelving top and bottom surfaces with [HPDL plastic laminate] [thermoset decorative overlay (melamine)]. Finish shelf edges in a [HPDL plastic laminate] [thermoset decorative overlay (melamine)] [PVC edgebanding].

### 2.12.5.2 Shelf Support System

The shelf support system is as follows:

#### 2.12.5.2.1 Recessed (Mortised) Metal Shelf Standards

Mortise standards flush with the finishes surface of the cabinet interior side walls, two per side. Position and space standards on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Install and adjust standards vertically to provide a level, stable shelf surface when clips are in place.

#### 2.12.5.2.2 Pin Hole Method

Drill holes on the interior surface of the cabinet side walls. Evenly space holes in two vertical columns. Space the holes in each column at [ 1 inch] [\_\_\_\_\_] increments starting [ 6 inches] [\_\_\_\_\_] from the cabinet interior bottom and extending to within [ 6 inches] [\_\_\_\_\_] of the top interior surface of the cabinet. Drill holes to provide a level, stable surface when the shelf is resting on the shelf pins. Coordinate hole diameter with pin insert size to provide a firm, tight fit.

## 2.12.6 Laminate Clad Countertops

Construct laminate countertop substrate of 3/4 inch [particleboard] [medium density fiberboard (MDF)] [veneer core plywood]. Use a moisture-resistant substrate where countertops receive sinks, lavatories, or are subjected to liquids. Provide substrates that have sink cutout edges and seal with appropriate sealant against moisture. Do not make joints cutouts. A balanced backer sheet is required.

### 2.12.6.1 Edge Style

Make front [and exposed side] countertop edges in shapes and to dimensions as shown on the drawings. Use the following countertop edge material:

#### 2.12.6.1.1 Post Formed Plastic Laminate

Make laminate edge integral with countertop surface. Make shape and profile [bullnose] [waterfall] [as indicated] [\_\_\_\_\_] and to dimensions as indicated.

#### 2.12.6.1.2 Hardwood

Indicate species, finish, profile, shape, and dimensions as indicated on the drawings. Lap hardwood edge over the exposed countertop laminate edge and install flush with the countertop laminate surface.

#### 2.12.6.1.3 Vinyl

Provide vinyl tee-mould edge in shape, thickness, and color as indicated on the drawings. Lap tee mould edge over the exposed countertop laminate edge and install flush with the countertop laminate surface.

#### 2.12.6.1.4 Plastic Laminate Self Edge

Flat, 90 degree "self " edge. Edge must be applied before top. Lap laminate edge over countertop laminate and ease to eliminate sharp corners.

#### 2.12.6.2 Laminate Clad Splashes

Countertop splash substrate must be  $3/4$  inch [particleboard] [MDF fiberboard] [veneer core plywood]. Laminate clad backsplash must be [integral with countertop, coved to radius and to dimensions as indicated on the drawings] [loose, to be installed at the time of countertop installation]. Provide and install loose, straight profile side splashes at the time of countertop installation. Match back and side splash laminate pattern and color to the adjacent countertop laminate.

#### 2.12.7 Laminate Application

Apply laminate to substrates following the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. Machined flush, file, sand, or buff all laminate edges to remove machine marks and ease (sharp corners removed). Clean up at easing must be such that no overlap of the member eased is visible. Perform fabrication in conformance to ANSI A161.2. Provide laminate types and grades for component surfaces as follows unless otherwise indicated on the drawings:

##### 2.12.7.1 Base/Wall Cabinet Case Body

- a. Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade [VGS] [VGP].
- b. Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: [HPDL Grade CLS] [Thermoset Decorative Overlay (melamine)].

##### 2.12.7.2 Adjustable Shelving

#### 2.12.7.2.1 Top and Bottom Surfaces

[HPDL Grade HGS] [Thermoset Decorative Overlay (melamine)]

#### 2.12.7.2.2 All Edges

[HPDL Grade VGS] [Thermoset Decorative Overlay (melamine)] [PVC edgebanding]

#### 2.12.7.3 Fixed Shelving

##### 2.12.7.3.1 Top and Bottom Surfaces

[HPDL Grade HGS] [Thermoset Decorative Overlay (melamine)]

##### 2.12.7.3.2 Exposed Edges

[HPDL Grade VGS] [Thermoset Decorative Overlay (melamine)] [PVC edgebanding]

#### 2.12.7.4 Door, Drawer Fronts, Access Panels

##### 2.12.7.4.1 Exterior (Exposed) and Interior (Semi-Exposed) Faces

HPDL Grade [VGS] [VGP]

##### 2.12.7.4.2 Edges

[HPDL Grade VGS] [PVC edgebanding]

#### 2.12.7.5 Drawer Assembly

All interior and exterior surfaces: [HPDL Grade CLS] [Thermoset Decorative Overlay (melamine)].

#### 2.12.7.6 Countertops and Splashes

All exposed and semi-exposed surfaces: HPDL Grade HGS

#### 2.12.7.7 Tolerances

Meet the [NAAWS 3.1](#) [premium] [custom] grade requirements for flushness, flatness, and joint tolerances of laminated surfaces.

#### 2.12.8 Finishing

##### 2.12.8.1 Filling

Do not expose fasteners on laminated surfaces. Make all nails, screws, and other fasteners in non-laminated cabinet components countersunk and fill the holes with wood filler consistent in color with the wood species.

##### 2.12.8.2 Sanding

Prepare all surfaces requiring coatings by sanding with a grit and in a manner that scratches will not show in the final system.

##### 2.12.8.3 Coatings

Types, method of application and location of casework finishes must be in accordance with the [finish schedule](#), drawings and Section [09 90 00 PAINTS](#)

AND COATINGS. Paint all cabinet reveals. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Provide written verification of conformance with **NAAWS 3.1** for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator must submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation must comply with applicable requirements for **NAAWS 3.1** [premium] [custom] quality standards. Install countertops and fabricated assemblies level, plumb, and true to line, in locations shown on the drawings. Attach and securely anchor cabinets and other **laminated clad casework** assemblies to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

#### 3.1.1 Anchoring Systems

##### 3.1.1.1 Floor

Utilize a floor anchoring system [as detailed on the drawings] for [base cabinets] [\_\_\_\_\_]. Anchoring and mechanical fasteners must not be visible from the finished side of the casework assembly. Attach [cabinet] [\_\_\_\_\_] assemblies to anchored bases without visible fasteners [as indicated in the drawings]. Where assembly abuts a wall surface, include a minimum **1/2 inch** thick lumber or panel product hanging strip, minimum **2-1/2 inch** width; securely attached to the top of the wall side of the cabinet back.

##### 3.1.1.2 Wall

Utilize minimum **1/2 inch** thick lumber or panel product hanging strips, minimum **2-1/2 inch** width to wall mount [cabinet] [vanity] [\_\_\_\_\_]; securely attach to the wall side of the cabinet back, both top and bottom.

#### 3.1.2 Countertops

Install countertops in locations as indicated on the drawings. Fasten countertops to supporting casework structure with mechanical fasteners, hidden from view. Fill all joints formed by the countertop or countertop splash and adjacent wall surfaces with a clear silicone caulk. Adhere loose [back] [side] splashes to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Fill joints between the countertop surface and splash with clear silicone caulk in a smooth consistent concave bead. Bead size must be the minimum necessary to fill the joint and any surrounding voids or cracks.

#### 3.1.3 Hardware

Install casework hardware in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be

used with particleboard or fiberboard doors, use plastic or synthetic insertion dowels to receive 3/16 inch "Euro screws". The use of wood screws without insertion dowels is prohibited.

#### 3.1.4 Doors, Drawers and Removable Panels

Accomplish the fitting of doors, drawers and removable panels within target fitting tolerances for gaps and flushness in accordance with NAAWS 3.1 [premium] [custom] grade requirements.

#### 3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with [Section 22 00 00 PLUMBING, GENERAL PURPOSE] [\_\_\_\_\_].

#### 3.1.6 Glass

Install glass and glazing in the casework using methods and materials specified in Section 08 81 00 GLAZING in locations as indicated on the drawings.

-- End of Section --

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## SECTION 06 61 16

## SOLID SURFACING FABRICATIONS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

- ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants
- ASTM D570 (1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
- ASTM D638 (2014) Standard Test Method for Tensile Properties of Plastics
- ASTM D696 (2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
- ASTM D790 (2017) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- ASTM D2583 (2013a) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM G21 (2015; R 2021; E 2021) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

- CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## CSA GROUP (CSA)

- CSA B45.5-17/IAPMO Z124 (2017; Errata 2017; Errata 2018) Plastic Plumbing Fixtures

## INTERNATIONAL CAST POLYMER ASSOCIATION (ICPA)

ICPA SS-1 (2001) Performance Standard for Solid Surface Materials

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure Decorative Laminates

## NSF INTERNATIONAL (NSF)

NSF/ANSI 51 (2012) Food Equipment Materials

## 1.2 SYSTEM DESCRIPTION

- a. Work under this section includes [\_\_\_\_\_] and other items utilizing solid surfacing material fabrications as indicated on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.
- b. In most instances, installation of solid surfacing material fabricated components and assemblies requires strong correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid surfacing material fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, counter tops, shelving, and all other solid surfacing material fabrications to the degree and extent recommended by the solid surfacing material manufacturer.
- c. Provide appropriate staging areas for solid surfacing material fabrications. Allow variation in component size and location of openings of plus or minus 1/8 inch.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Fabrication Drawings; G[, [\_\_\_\_\_]]

Installation; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Solid Polymer; G[, [\_\_\_\_\_]]

Indoor air quality for solid surface seam and sealant products; S  
[, [\_\_\_\_\_]]

[ Quartz Agglomerate Material; G[, [\_\_\_\_]]

] SD-04 Samples

Material; G[, [\_\_\_\_]]

Counter Tops; G[, [\_\_\_\_]]

SD-06 Test Reports

Test Report Results

SD-07 Certificates

Qualifications

Indoor Air Quality for solid surface fabrication products; S[, [\_\_\_\_]]

SD-10 Operation and Maintenance Data

Solid Polymer, Data Package 1; G[, [\_\_\_\_]]

[ Quartz Agglomerate Material, Data Package 1; G[, [\_\_\_\_]]

#### ] 1.4 QUALITY ASSURANCE

##### 1.4.1 Qualifications

To ensure warranty coverage, provide manufacturer certified solid surfacing fabricators to fabricate the solid surfacing material being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Minimum of 5 years of experience working with solid surfacing materials is required of fabricators. Submit solid surfacing material manufacturer's certification attesting to fabricator qualification approval.

##### 1.4.2 Mock-ups

Submit [Detail Fabrication Drawings](#) indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work. Prior to final approval of shop drawings, provide a full-size mock-up of a typical [counter top] [shelving] [\_\_\_\_] where multiple units are required. Include all solid surfacing material components required to provide a completed unit. Utilize finishes in patterns and colors[ as specified in Section 09 06 00 SCHEDULES FOR FINISHES.][ as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.] in the mock-up. Should the mock-up not be approved, re-work or remake it until approval is secured. Remove rejected units from the jobsite. Approved mock-up may remain as part of the finished work.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Store materials indoors and take adequate precautions to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage

or staining following installation, for duration of project.

## 1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials[, excluding damages caused by physical or chemical abuse or excessive heat,] and workmanship for a period of [10] [\_\_\_\_\_] years from date of final acceptance of the work.

## PART 2 PRODUCTS

### 2.1 MATERIAL

Submit detail fabrication drawings and installation drawings of each solid surfacing fabrication indicated. Include elevations, dimensions, clearances, details of construction and anchorage, and details of joints and connections.

Submit manufacturers' descriptive product data for [each type of] solid polymer fabrication [and quartz agglomerate fabrication] indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for [each type of] solid polymer fabrication [and quartz agglomerate material fabrication] in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

#### 2.1.1 Solid Surfacing Material

Provide solid polymer[ and] [ quartz agglomerate material] that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction, complying with ICPA SS-1[ and ICPA SS-1 for quartz agglomerate, except for composition]. Provide material that meets or exceeds the minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch must be repairable by sanding or polishing. Material thickness is as[ indicated below] [ indicated on the drawings]; required minimum thickness is 1/4 inch. Submit a minimum 4 inch by [4] [\_\_\_\_\_] inch sample of each color and pattern for approval; include full range of color and pattern variation. Retain approved samples as a standard for this work. Submit test report results from an independent testing laboratory attesting that the submitted solid surfacing materials meet or exceed each of the specified performance requirements.

- a. Horizontal Surfaces:[ 1/2 inch thick material][ 3/4 inch thick material] [\_\_\_\_\_] ]
- b. Vertical Surfaces:[ 1/4 inch thick material][ 1/2 inch thick material] [\_\_\_\_\_] ]
- c. Provide materials that meet the emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type). Provide certification or validation of indoor air quality for solid surface fabrication products.

#### 2.1.2 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material composed of acrylic polymer, mineral fillers, and pigments. Provide acrylic polymer that meets or exceeds the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (max.)	ASTM D638
Hardness	55-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4 inch sheet	36-inches, 1/2 lb ball, no failure	
1/2 inch sheet	140-inches, 1/2 lb ball, no failure	
3/4 inch sheet	200-inches, 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51
Flexural Strength	[6,800] [10,400] psi (min.)	ASTM D790

### 2.1.1.3 Acrylic-modified Polymer Solid Surfacing Material

Cast, solid polymer material composed of a formulation containing acrylic and polyester polymers, mineral fillers, and pigments. Provide acrylic polymer content not less than 5 percent and not more than 10 percent in order to meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4100 psi (max.)	ASTM D638
Hardness	50-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4 inch sheet	36 inches, 1/2 lb ball, no failure	
1/2 inch sheet	140 inches, 1/2 lb ball, no failure	
3/4 inch sheet	200 inches, 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.6 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	100 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51
Flexural Strength	[6,800] [10,400] psi (min.)	ASTM D790

#### [2.1.4 Quartz Agglomerate (or "Engineered Quartz") Solid Surfacing Material

Solid sheets consisting of quartz aggregates in an acrylic or polyester, or a combination of the two, resin binder (or matrix) that is solid and nonporous with integral color.

#### ]2.1.5 Material Patterns and Colors

Provide pattern and color for all solid surfacing material components and

fabrications [as specified in Section 09 96 00 SCHEDULES FOR FINISHES.] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.] Provide products with consistent patterned color throughout thickness of the product.

#### 2.1.6 Surface Finish

Provide a uniform appearance on exposed finished surfaces and edges. Exposed surface finish is [matte; gloss rating of 5-20] [semigloss; gloss rating of 25-50 ] [polished; gloss rating of 55-80] [as indicated].

### 2.2 ACCESSORY PRODUCTS

Provide accessory products, as specified below, as manufactured by the solid surfacing material manufacturer or as approved by the solid surfacing material manufacturer for use with the solid surfacing materials being specified.

#### 2.2.1 Adhesives

Provide a two-part seam adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid surfacing materials and components to create a monolithic appearance of the fabrication. Provide adhesive approved by the solid surfacing material manufacturer. Color-match adhesive to the surfaces being bonded where solid-colored, solid surfacing materials are being bonded together. Provide clear or color matched seam adhesive where particulate patterned, solid surfacing materials are being bonded together.

#### 2.2.2 Seam and Sealant Emissions

Provide seam and other accessory materials that meet the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type). Provide validation of [indoor air quality for solid surface seam and sealant products](#).

#### 2.2.3 Silicone Sealant

Provide silicone sealant, mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, acid-curing; [ASTM C920](#), Type S, Grade NS, Class 25, Use NT; clear formulation; approved for use by the solid surfacing material manufacturer.

#### 2.2.4 Conductive Tape

Provide manufacturer's standard conductive foil tape, [4 mils](#) thick, applied around the edges of cut outs containing hot or cold appliances.

#### 2.2.5 Insulating Tape

Provide manufacturer's standard insulating tape for use with drop-in food wells used in commercial food service applications to insulate solid surfacing material from hot or cold appliances.

#### 2.2.6 Heat Reflective Tape

Provide heat reflective tape as recommended by the solid surfacing material manufacturer for use with cutouts for heat sources.

### 2.2.7 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

## 2.3 FABRICATIONS

Provide factory or shop fabricate components to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii must be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid surfacing material, joint adhesive, sealants, and heat reflective tape. [ Both the manufacturer of materials and the fabricator are required to submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.]

### 2.3.1 Joints and Seams

Form joints and seams between solid surfacing material components using manufacturer's approved seam adhesive. Provide inconspicuous joints in appearance without voids to create a monolithic appearance.

### 2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Provide edge shapes and treatments, including any inserts, as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

### 2.3.3 Counter Top Splashes

Fabricate backsplashes and end splashes from [ 1/2 inch] [\_\_\_\_\_] thick solid surfacing material to be [[ 4 inches] [\_\_\_\_\_] high] [in conformance with dimensions and shapes as indicated]. Provide backsplashes and end splashes [for all counter tops] [at locations indicated]. Shop fabricate backsplashes and provide [permanently attached] [loose, to be field attached].

#### 2.3.3.1 Permanently Attached Backsplash

Provide permanently attached backsplashes [straight with seam adhesive to form a 90 degree transition] [with seam adhesive and to form a radiused coved transition from counter top to backsplash].

#### 2.3.3.2 End Splashes

Provide end splashes loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

### 2.3.4 Shelving

Fabricate shelving [and wall support brackets] from [ 1/2 inch] [\_\_\_\_\_] thick solid surfacing material; dimensions, edge shape, and other details



as indicated.

### 2.3.5 Window Stools

Fabricate window stools from [ 1/2 inch] [\_\_\_\_\_] thick solid surfacing material; dimensions, edge shape, and other details [as indicated] [as selected from manufacturer's available pre-fabricated standards] [equal to the width of the window opening by a 1/2 inch overhang of the window sill depth] [\_\_\_\_\_] . Provide [square] [bullnose] [\_\_\_\_\_] edge profile.

### 2.3.6 Counter Tops

Fabricate all solid surfacing material, counter top components from [ 1/2 inch] [ 3/4 inch [\_\_\_\_\_] thick material. Indicate details, dimensions, locations, and quantities on the drawings. Provide counter tops with [ 4 inch] [\_\_\_\_\_] high [loose] [permanently attached, 90 degrees transition] [permanently attached with coved transition backsplash and loose endsplashes] [at all locations] as indicated]. Attach 2 inch wide reinforcing strip of solid surfacing material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings; include the edge profile and backsplash as detailed on the drawings and at least one seam. Retain approved sample as standard for this work. Provide [square] [bullnose] [\_\_\_\_\_] edge profile.

#### 2.3.6.1 Counter Tops with Sinks

- [ a. Provide stainless steel or vitreous china sink; include cutouts to template for counter tops with sinks as furnished by the sink manufacturer. Provide manufacturer's standard sink mounting hardware for [stainless steel] [vitreous china] [rimless] [\_\_\_\_\_] installation. Seal between sink and counter top with specified silicone sealant. Provide sink, faucet, and plumbing requirements in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE. [\_\_\_\_\_] ]
- ] [b. Provide manufacturer's standard solid polymer sinks, pre-molded product specifically designed for attachment to solid surfacing material counter tops. See paragraph SOLID POLYMER SINKS for additional requirements.

#### ] 2.3.6.2 Counter Tops with Bowls

- [ a. Include cutouts to template for counter tops with vitreous china bowls as furnished by the sink manufacturer. Provide manufacturer's standard sink mounting hardware for vitreous china [rimless] [\_\_\_\_\_] installation. Seal between sink and counter top with specified silicone sealant. Provide sink, faucet, and plumbing requirements in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE. [\_\_\_\_\_] .
- ] [b. Provide manufacturer's standard solid polymer bowls, pre-molded product specifically designed for attachment to solid surfacing material counter tops. See paragraph SOLID POLYMER BOWLS for additional requirements
- ] ]
- [ c. Provide manufacturer's standard pre-fabricated one-piece counter top and bowl fabrications. Each unit includes a counter top with integral backsplash and sink bowl. See paragraph SOLID POLYMER BOWLS for additional requirements.

## ]2.3.6.3 Cafeteria Counter Tops

Include cutouts for cold or hot appliances to templates furnished by the equipment manufacturers. Reinforce joints and cutouts as recommended by the solid surfacing material manufacturer. Provide insulation between the solid surface material and all appliances, hot or cold. Thermally isolate hot applications from cold applications in accordance with the solid surfacing material manufacturer's recommendations. Provide expansion joints as necessary to accommodate hot appliances. Provide adequate ventilation for cabinets beneath counter tops to prevent heat build-up.

## [2.3.7 Solid Polymer Sinks

Provide solid polymer sinks that are a standard product of the solid polymer manufacturer, in compliance with [CSA B45.5-17/IAPMO Z124](#) requirements, designed specifically to be installed in solid surfacing material counter tops. Provide sinks of the same polymer composition as the adjoining counter top. Sink design must support a [seam adhesive undermount] [seam adhesive flush] installation method. Sinks must be [single bowl] [double bowl] [double bowl with molded drainboard] configuration. Bowl dimensions must be [as indicated] [\_\_\_\_\_].

## ] [2.3.8 Solid Polymer Bowls

Provide solid polymer bowls that are a standard product of the solid polymer manufacturer, in compliance with [CSA B45.5-17/IAPMO Z124](#) requirements, designed specifically to be installed in solid surfacing material counter tops. Provide bowls of the same polymer composition as the adjoining counter top. Bowl design must support a [seam adhesive undermount] [seam adhesive flush] installation method. Bowl dimensions must be [as indicated] [\_\_\_\_\_].

## ]2.3.9 Tub/Shower Wall Panel System

Provide tub/shower wall enclosures with a system of solid surfacing material components to include: [panels] [corner trim] [soap dish] [shampoo shelf] [panel edge trim] [\_\_\_\_\_]; dimensions of all components are [as indicated] [standard manufacturer's dimensions to be field cut to fit]. Form panels from manufacturer's standard [ 1/4 inch] [ 1/2 inch] [\_\_\_\_\_] thick sheet product. Provide panels full width and height with seams occurring only at the inside corners of the enclosure. [ Provide soap dish and shampoo shelf of configuration, shape, and location [as indicated] [as standard with the manufacturer's system].]

## 2.3.10 Wall Cladding/Wainscoting

Provide solid surfacing material wall cladding or wainscoting to dimensions and in locations as indicated on the drawings. Fabricate panels from manufacturer's standard [ 1/4 inch] [ 1/2 inch] [\_\_\_\_\_] thick sheet product. Provide panels to heights indicated on the drawings with no horizontal seaming; utilize the maximum panel dimension available to minimize vertical seams.

## 2.3.11 Toilet Partition System

Refer to Section [10 21 13](#) TOILET COMPARTMENTS.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid surfacing material components using solid surfacing material manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid surfacing material manufacturer's recommended clear silicone sealant and mounting hardware. Install solid polymer sinks and bowls using a color-matched seam adhesive.

##### 3.1.1.1 Loose Counter Top Splashes

Mount loose splashes in the locations noted on the drawings. Adhere loose splashes to the counter top with a color matched silicone sealant when the solid surfacing material components are solid colors. Use a clear silicone sealant to provide adhesion of particulate patterned solid surfacing material splashes to counter tops.

##### 3.1.1.2 Wall Panels & Panel Systems

Installation of wall panels and system components to substrates must include the use of a specified panel adhesive. Use specified seam adhesive to adhere all solid surfacing material components to each other with the exception of expansion joints and inside corners. All inside corners and expansion joints between solid surfacing material components must be joined with specified silicone sealant. All joints between solid surfacing material components and non-solid polymer surfaces must be sealed with specified silicone sealant.

#### 3.1.2 Silicone Sealant

Use specified silicone sealant to seal all expansion joints between solid surfacing material components and all joints between solid surfacing material components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Provide sealant bead smooth and uniform in appearance and minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Provide continuous bead and run the entire length of the joint being sealed.

#### 3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section [22 00 00 PLUMBING, GENERAL PURPOSE] [\_\_\_\_\_].

### 3.2 CLEAN-UP

Components must be cleaned after installation and covered to protect against damage during completion of the remaining project items. Damaged components must be repaired or replaced at the Contractor's sole expense.

-- End of Section --

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## SECTION 07 11 13

## BITUMINOUS DAMPPROOFING

08/11, CHG 1: 05/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C728	(2017; R 2022) Standard Specification for Perlite Thermal Insulation Board
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D43/D43M	(2000; R 2012) Standard Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D227/D227M	(2003; R 2011; E 2012) Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D449/D449M	(2003; R 2014; E 2014) Asphalt Used in Dampproofing and Waterproofing
ASTM D450/D450M	(2007; E 2013; R 2013) Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D1227	(2013) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4479/D4479M	(2007; E 2012; R 2012) Asphalt Roof Coatings - Asbestos-Free

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926

Safety and Health Regulations for  
Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-07 Certificates

## Materials

## 1.3 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels shall include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life. While in storage, do not allow water based bituminous damproofing to freeze.

## [1.4 SAFETY AND HEALTH REQUIREMENTS

If coal-tar pitch materials are used, the Contractor shall conform to all OSHA 29 CFR 1926 and General Industry Health Standards as well as state and local standards.

## ] PART 2 PRODUCTS

## [2.1 ASPHALT

ASTM D449/D449M, Type I or Type II.

## ] 2.2 ASPHALT PRIMER

ASTM D41/D41M.

## [2.3 CREOSOTE PRIMER

ASTM D43/D43M.

## ] [2.4 COAL-TAR PITCH

ASTM D450/D450M, Type II or Type III.

## ] [2.5 FIBROUS ASPHALT

ASTM D4479/D4479M, Type I for horizontal surfaces, Type II for vertical surfaces.

## ] [2.6 EMULSION-BASED ASPHALT DAMPPROOFING

## 2.6.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to [ASTM D1227](#) Type II, Class 1, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

#### 2.6.2 Non-Fibrated Emulsion-Based Asphalt

Non-fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to [ASTM D1187/D1187M](#) Type II or [ASTM D1227](#) Type III, manufactured of refined asphalt, emulsifiers and selected clay. Asphalt shall contain a minimum 58 percent solids by weight, 55 percent solids by volume.

### ] 2.7 SURFACE PROTECTION

#### 2.7.1 Saturated Felt

[ASTM D226/D226M](#), Asphalt Saturated, Type I, 15 pound; [ASTM D227/D227M](#), Coal-Tar Saturated.

#### 2.7.2 Protection Board

Wood Fiber Board, [ASTM C208](#), or Perlite Board, [ASTM C728](#).

### ] PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

[Remove or cut form ties and repair all surface defects as required in Section [03 30 00 CAST-IN-PLACE CONCRETE](#).] Clean [concrete and] masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with [ASTM D4263](#). If test indicates moisture, allow a minimum of 7 additional days after test completion for curing. If moisture still exists, redo test until substrate is dry.

##### [3.1.1 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

##### ] 3.2 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of dampproofing material onto other work. [Drains and conductors shall be protected from clogging with dampproofing material.]

#### 3.3 APPLICATION

[Use either hot-application or cold-application method. Use cold-application method in confined spaces where hot bitumen would be hazardous.] [Prime surfaces to receive fibrous asphaltic dampproofing unless recommended otherwise by dampproofing materials manufacturer.] Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40

degrees F.

### 3.3.1 Surface Priming

[Prime surfaces to receive coal-tar pitch dampproofing with creosote primer.] [Prime surfaces to receive [asphalt or] [fibrous asphalt dampproofing with asphalt primer].] Apply primer when ambient temperature is above 40 degrees F and at rate of approximately one gallon per 100 square feet, fully covering entire surface to be dampproofed.

### [3.3.2 Hot-Application Method

Apply two mop coats of hot coal-tar pitch or two mop coats of hot asphalt to surfaces. Apply mop coats uniformly using not less than 25 pounds of coal-tar pitch or 20 pounds of asphalt per 100 square feet for each coat. Do not heat asphalt above 450 degrees F. Do not heat coal tar pitch above 400 degrees F. Have kettlemen in attendance at all times during heating to ensure that maximum temperature specified is not exceeded. Apply hot asphalt bitumen or coal tar pitch and fully bond to primed surface. Provide finished surface that is smooth, lustrous, and impervious to moisture. Recoat dull or porous spots.

### ] 3.3.3 Cold-Application Method

#### [3.3.3.1 Fibrous Asphalt

Apply two coats of fibrous asphalt to surfaces to be dampproofed. Apply each coat uniformly using not less than one gallon fibrous asphalt per 50 square feet. Apply first coat by brush or spray to provide full bond with primed surface. Brush or spray second coat over thoroughly dry first coat [unless recommended otherwise by dampproofing materials manufacturer]. Provide finished surface that is of uniform thickness and impervious to moisture. Recoat porous areas.

#### ] [3.3.3.2 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 40 degrees F. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 12 mils thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

- a. Primer: 1/2 gallon per 100 square feet, cold-applied.
- b. Fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.
- c. Non-fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

### ] [3.4 PROTECTIVE COVERING

Protect dampproofed surfaces against which backfill will be placed with [one layer of 15 pound saturated felt conforming to the requirements specified herein. Use asphalt-saturated felt where the dampproofing material is asphalt and use coal-tar-saturated felt where the dampproofing



material is coal-tar pitch. Embed felts in the second coating of bitumen and lap edges and ends not less than one inch] [1/2 inch thick wood fiberboard or perlite board].

] -- End of Section --

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## SECTION 07 12 00

## BUILT-UP BITUMINOUS WATERPROOFING

02/16

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C726	(2017) Standard Specification for Mineral Wool Roof Insulation Board
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D173/D173M	(2003; R 2011; E 2012) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D449/D449M	(2003; R 2014; E 2014) Asphalt Used in Dampproofing and Waterproofing
ASTM D517	(1998; R 2008) Asphalt Plank
ASTM D1327/D1327M	(2004; R 2020) Standard Specification for Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
ASTM D1668/D1668M	(1997a; R 2014; E 2014) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D2178/D2178M	(2015a) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a

code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

- Manufacturer's Standard Details, G[, [\_\_\_\_\_]]
- Protection Board; G[, [\_\_\_\_\_]]
- [ Prefabricated Laminated Asphalt Waterproofing; G[, [\_\_\_\_\_]]
- ] [ Prefabricated Copper Fabric; G[, [\_\_\_\_\_]]
- ] Membrane Fabric; G[, [\_\_\_\_\_]]
- Reinforcing Fabric; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

- Bulk Liquid Asphalt Certified Laboratory Reports; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

- Membrane Fabric; G[, [\_\_\_\_\_]]
- Reinforcing Fabric; G[, [\_\_\_\_\_]]
- Protection Board; G[, [\_\_\_\_\_]]
- [ Prefabricated Laminated Asphalt Waterproofing; G[, [\_\_\_\_\_]]
- ] [ Prefabricated Copper Fabric; G[, [\_\_\_\_\_]]
- ] Certificates of Compliance; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

- Installation Instructions

#### SD-11 Closeout Submittals

- Asphalt Shipment Records
- Certificates of Compliance; S
- Volatile Organic Compounds (VOC) Contents; S
- Recycled Content; S

### 1.3 MANUFACTURER'S DETAIL

Submit manufacturer's standard details indicating methods of attachment and spacing, transition and termination conditions, installation details.

### 1.4 ENVIRONMENTAL CONDITIONS

Apply the primers and waterproofing specified herein when the ambient

temperature is above 40 degrees F.

## 1.5 DELIVERY AND STORAGE

### 1.5.1 Materials Packaging

Deliver materials in bundles, rolls, and sealed containers in accordance with manufacturer's printed handling instructions and bearing manufacturer's original labels. Material labels indicate dates for use or shelf life; remove outdated material, damaged, and deteriorated material from the jobsite. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth.

### 1.5.2 Materials Storage

#### 1.5.2.1 Asphalt

Protect asphalt from freezing. Store asphalt in a weathertight enclosure, free from contact with soil. Store and maintain at not less than 50 degrees F for at least 24 hours before use.

#### 1.5.2.2 Reinforcement Fabrics

Handle and store reinforcement fabrics in accordance with manufacturer's printed instructions. Protect fabrics from moisture damage and absorption in a weathertight enclosure or off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup therefore do not use them to cover waterproofing materials.

#### [1.5.3 Bulk Liquid Asphalt

Deliver bulk liquid asphalt in fully insulated, heated transport tanker vehicles with circulating pump devices. Maintain the temperature of the liquid asphalt between 400 and 450 degrees F during storage, provided the transport and storage time does not exceed 12 hours. If the transport and storage time exceeds 12 hours, lower the temperature to between 300 and 325 degrees F at the time the 12 hours are exceeded. Use liquid asphalt within 36 hours after loading in the transport tanker. Provide bulk liquid asphalt certified laboratory reports for results of tests performed on asphalt delivered to the construction site by bulk liquid asphalt tankers.

##### 1.5.3.1 Asphalt Shipment Records

Obtain from the bulk liquid asphalt manufacturer a certified shipping statement for each asphalt shipment. Following completion of the waterproofing installation, submit certificates to the Contracting Officer for verification and recordkeeping. Indicate the following:

- a. Manufacturer's name
- b. Specification identification of asphalt
- c. Quantity of asphalt
- d. Documentation of transport tanker having been empty and free of foreign and incompatible materials at the time of loading

- e. Date, time, and temperature of asphalt at time of loading

## ]1.6 Flame Heated Equipment

### 1.6.1 Fire Protection

Locate melt kettles no closer than **25 feet** from buildings or combustible materials. Provide and maintain two approved 4-A:40-B:C fire extinguishers within **25 feet** of each operating kettle. Fire extinguishers, operations and locations must comply with NFPA 1 Section Tar Kettles. Equip asphalt (tar) kettles with tight fitting lids.

### 1.6.2 Operational Requirements

Equip kettles with automatic thermostatic control capable of maintaining asphalt temperature. Calibrate and maintain controls in working order for the duration of the work. Equip kettles with means of agitation and ensure they are operating as necessary to produce a controlled uniform temperature throughout kettle contents to prevent spot heating. Do not heat contents above flash point. Do not place flame heated equipment on the roof.

### 1.6.3 Drillage of Bitumen

Seal joints in and at edges as necessary to prevent drillage of asphalt into the building or onto adjacent surfaces.

## PART 2 PRODUCTS

### 2.1 PRODUCT SUSTAINABILITY CRITERIA

Where allowed by performance criteria:

#### 2.1.1 Reduce **Volatile Organic Compounds (VOC) Contents**

Provide products with reduced VOC content and provide **certificates of compliance** in accordance with Section **01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING** paragraph **REDUCE VOLATILE ORGANIC COMPOUNDS**.

#### 2.1.2 **Recycled Content**

Provide products with recycled content and provide **certificates of compliance** in accordance with Section **01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING** paragraph **RECYCLED CONTENT**.

### 2.2 BITUMEN

Asphalt; **ASTM D449/D449M**, Type [I] [II] [III].

### 2.3 BITUMINOUS PLASTIC CEMENT

**ASTM D4586/D4586M**, Type [I] [II] for asphalt.

### 2.4 **MEMBRANE FABRIC**

The following requirements apply:

<u>Felt or Fabric Material</u>	<u>Saturant or Impregnant</u>	<u>Specification</u>
Glass (felt) mat	Asphalt	ASTM D2178/D2178M, Type III
Cellulose fiber mat-based (organic) felt	Asphalt	ASTM D226/D226M
Reinforcing glass fabric	Asphalt	ASTM D1668/D1668M REV A, Type I
Reinforcing cotton fabric	Asphalt	ASTM D173/D173M
Reinforcing woven burlap fabric	Asphalt	ASTM D1327/D1327M

#### 2.4.1 Cotton Fabrics

Provide cotton fabrics woven entirely of cotton in accordance with ASTM D173/D173M and thoroughly and uniformly saturated with asphalt.

#### 2.4.2 Woven Burlap Fabrics

Provide woven burlap fabrics in accordance with ASTM D1327/D1327M composed of 100 percent jute fiber and two cotton threads at each selvage, and thoroughly and uniformly saturated with asphalt. Fabric cannot be completely closed or sealed by the process of saturation and is to have sufficient porosity to allow successive moppings of plying asphalt to seep through. Fabric surface cannot be coated or covered with talc or any other substance that interferes with the adhesion between fabric and plying asphalt. Provide fabric surface uniformly smooth and free of irregularities, folds, knots, ragged or untrue edges, breaks, cracks, and other visible defects.

#### 2.5 NAILS

Provide galvanized roofing nails or nails in accordance with fabric and protection board manufacturer's written recommendations. If fabric contains metal, provide nails as necessary to avoid electrolytic action due to proximity of dissimilar metals.

#### 2.6 PRIMER

ASTM D41/D41M for asphalt.

#### 2.7 PROTECTION BOARD

ASTM D517, plain, asphalt plank; ASTM C208, construction grade building board, 1/2 inch thick, asphalt saturated or coated; ASTM C726, 7/16 inch thick, covered on one side with waterproof paper or asphalt-saturated felt.

#### [2.8 PREFABRICATED LAMINATED ASPHALT WATERPROOFING

Provide prefabricated laminated construction consisting of plies of kraft paper bonded by layers of bitumen reinforced with layers of fibrous glass and one layer of polyethylene facing. MProvide material and weight as follows:

- a. One layer polyethylene facing, 30 lbs. ream weight; seven intermediate

layers of bituminous-saturated kraft paper.

- b. Seven layers of bitumen.
- c. Three layers of 20.20 fibrous glass mesh.
- d. Bottom "cushion" sheet of crepe kraft paper.
- e. Total minimum weight of materials of 0.40 lbs. per square foot.
- f. Minimum bituminous content of 75 percent by weight.
- g. Permanently pliable and impervious to mildew and other organic attack, including termites and rodents.
- [ h. Puncture resistant and self sealing.

]] [2.9 PREFABRICATED COPPER FABRIC SHOWER PANS

A factory fabricated sheet of copper bonded to and between two layers of asphalt impregnated fiberglass or cotton fabric. Copper sheet to weigh [3] [5] [7] ounces per square foot.

]2.10 WOOD NAILERS

Specified in Section 06 10 00 ROUGH CARPENTRY.

PART 3 EXECUTION

3.1 INSPECTION OF SURFACES

Before starting the work, inspect all surfaces that must be waterproofed to determine if in satisfactory condition. Check the location and setting of all embedded items. Place backing and blocking and perimeter framing for recessed items as required by the various trades on the project. Complete conduit, piping, and other required rough-in. Notify the Contracting Officer of serious defects or conditions that prevent satisfactory application. Start application after such defects and conditions have been corrected.

3.2 PREPARATION OF SURFACES

Ensure surfaces to receive treatment are clean and dry, smooth and free from deleterious and excess materials and projections. [Ensure masonry surfaces are free of oil, grease, dirt, laitance, loose and broken material, frost, debris and other contaminants.] [Ensure concrete surfaces are properly cured, free of release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Thoroughly wet holes, joints, cracks, and voids in concrete with water, then fill with Portland cement mortar, strike flush, and permit to dry.] Cut off or grind high spots smooth. [Ensure mortar joints in masonry walls are flush and free of extraneous mortar.] [Ensure metal surfaces are dry and free of rust, scale, loose paint, oil, grease, dirt, frost and debris.] Coat surfaces to receive asphalt membrane waterproofing with a priming coat of asphalt primer. Apply priming coat at a rate of not less than one gallon per 100 square feet, covering the entire waterproofed surface. Allow primer to dry per manufacturer's printed instructions before applying waterproofing.



### 3.3 APPLICATION

#### 3.3.1 Building Envelope Requirements

Provide a continuous waterproofing system at all material and building transitions. Lap, wrap, fasten and seal products in accordance with manufacturer's printed instructions. Locate waterproofing components within envelope assemblies in locations indicated on the Drawings. Envelope assembly variations are not permitted without written approval from the Contracting Officer's Representative.

#### 3.3.2 General Installation Requirements

Provide waterproofing where indicated. [At the Contractor's option, shower pans of [prefabricated laminated asphalt waterproofing] [or] [prefabricated copper fabric shower pan], as specified herein, may be used instead of bituminous membrane waterproofing.] [Provide ventilation for enclosed spaces when using bituminous membrane waterproofing.]

#### 3.3.3 Prefabricated Pan

Provide [prefabricated laminated asphalt waterproofing] [or] [prefabricated copper fabric shower pan]. Form each shower pan from a single piece of the laminated material without joints and with no opening except for shower drain. Provide pan in accordance with manufacturer's printed instructions.

#### 3.3.4 Protection of Surrounding Areas

Before starting waterproofing work, protect surrounding areas and surfaces from spillage and migration of asphalt onto other work. Provide non-combustible protective coverings at surfaces adjacent to hoists and kettles. Lap protective coverings at least 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of asphalt work. [ Protect drains and conductors from clogging with asphalt.]

#### 3.3.5 Heating and Application of Bitumen Coatings

Heat solid bitumen in kettle equipped with an automatic heating device or control unit for positive control of the specified temperature. Provide an accurate and clearly readable thermometer on all kettles. [Bulk liquid asphalt may be heated using the heating equipment in the transport tanker vehicle or transferred to kettles and heated as specified for solid bitumen.] Heat bitumen to flow freely but not above 375 degrees F. Apply bitumen over the primer, between each ply and as a top coating at the rate of not less than 20 pounds of asphalt per 100 square feet of surface.

#### [3.3.6 Membrane Waterproofing

##### 3.3.6.1 Below Grade Wall Waterproofing

Provide [1-ply] [2-ply] [3-ply] [4-ply] [5-ply] hot-applied asphalt membrane system for foundation walls. Install fabrics in accordance with manufacturer's printed installation instructions. Caulk joints before applying primer. Apply primer at a rate of 1/2 gallon per 100 square feet. Overlap fabrics at ends and stagger a minimum of [10 inch for 1-ply] [19 inch for 2-ply] [24 inch for 3-ply] [27 inch for 4-ply] [30 inch for 5-ply] system. End-to-end taping is not acceptable. Firmly embed each fabric in a solid uniform coating of hot asphalt at a rate of [20 lbs. per 100 square

feet] [\_\_\_\_\_] lbs. per 100 square feet. Allow asphalt to penetrate each fabric and to provide required adhesion. Avoid excessive applications of asphalt between fabrics in order to prevent slippage. Provide waterproofing system consisting of two or more fabrics with fabric reinforcement at corners, angles, over construction joints, and in locations where subject to increased stress.

#### [3.3.6.2 Floor Waterproofing

Apply primer at a rate of 1/2 gallon per 100 square feet. Do not allow primer to puddle. Confirm primer is dry to the touch before application of asphalt. Where slab abuts walls, extend first reinforcing fabric a minimum of 6 inches on slabs and 8 inches on walls. At vertical corners, extend first fabric a minimum of 5 inches from corners on each side. Lap second fabric with the first fabric a minimum of 2 inches. At floor drains, and elsewhere as indicated, extend fabric into a clamping device, set in a heavy coating of flashing cement, and securely clamp.

#### ]3.3.7 Fabric Membrane Reinforcement

Provide fabric membranes to reinforce felts at intersections. Provide reinforcement consisting of two plies of fabric membrane cemented in place and to each other with bituminous plastic cement not less than 1/16 inch thick for each coating. At the intersection of slabs and vertical surfaces, extend the first ply at least 6 inches on the slab and 4 inches up the vertical surface. At intersections of two vertical surfaces, extend the first ply at least 10 inches on each side of the intersection. Place second ply to lap the first by not less than 2 inches.

#### 3.3.8 Keyed Joint Footings

Provide membrane flashing, neatly formed, to the contours of keyed joints in foundation wall footings. Extend flashing to the outside edge of the footing, and turn the flashing down 4 inches. Continue the flashing through the joint to the inside of the walls and lap the flashing into the waterproofing membrane under the slab. Protect the flashing until it is lapped by the waterproofing membranes for the subsurface floor slabs and foundation walls. Provide flashing membrane made up of the same number and type materials as the waterproofing membrane or a thermoplastic material compatible with the waterproofing materials, as recommended by the manufacturer in writing.

#### 3.3.9 Flashing Flanges

Prime flashing flanges of pipe sleeves and ducts penetrating the waterproofing membrane. Allow primer to dry. Provide flanges with two fabric membrane collars cemented in place and to each other with bituminous plastic cement. Extend collars 4 and 6 inches, respectively, beyond the edge of the flanges, cover the flanges, and fit the flanges tight against the sleeve. Extend waterproofing connected to work exposed to weather to the back of the adjoining work, or counter flash to form a watertight connection.

#### 3.3.10 Clamping Devices

At floor drains and elsewhere, as indicated, extend membrane into clamping device set in heavy coating of bituminous plastic cement, and clamp securely.

### 3.3.11 Reglets

Install continuous reglets [as specified in Section [07 60 00 FLASHING AND SHEET METAL] [\_\_\_\_]] to receive the exposed edges of membrane waterproofing. After placement of waterproofing, completely fill reglets with bitumen.

## 3.4 FIELD TEST

### 3.4.1 Sampling and Testing of Bulk Liquid Asphalt

Notify the Contracting Officer 5 working days prior to the delivery date of asphalt. Take a minimum of one quart sample of each shipment of bulk liquid asphalt when the shipment arrives at the construction site. Obtain samples in the presence of the Contracting Officer using clean one quart, friction lid cans. Label samples to indicate project contract number, location where used on project, and date and time of arrival of shipment from which sample is taken. Give samples to the Contracting Officer for safekeeping until picked up by the testing laboratory. Pay for the testing of the bulk liquid asphalt by an independent testing company. Samples tested that are found not in compliance with specified requirements will be rejected. Remove and replace with new materials all waterproofing components installed with asphalt from which the noncompliant samples were taken, at no cost to the Government.

### 3.4.2 Test of Membrane Waterproofing

Prior to concealment, plug the drain and cover membrane waterproofing on horizontal surfaces over finished spaces with [3] [4] inches of ponded water for 24 hours to test watertightness. Make careful measurement of the water level at the beginning and end of the 24-hour period. If water level falls, drain the water, and thoroughly dry and inspect the waterproofing membrane. Make repairs or replacement, as directed, and repeat test. Do not proceed with work that conceals membrane waterproofing before approval of test results.

## 3.5 PROTECTIVE COVERING

### 3.5.1 Vertical Surfaces

Protect membrane waterproofing against which backfill must be placed by providing protective covering pressed into the final mopping while the mopping of bitumen is still hot. Butt edges of protection board against adjacent edges of protection boards. Cover exposed surfaces with a coating of bitumen. Where surfaced fiberboard or mineral fiberboard is used, place surface side facing outward. Fit board around pipes and projections so as to cover the entire surface of the membrane waterproofing.

### 3.5.2 Horizontal Surfaces

Place protective covering over membrane immediately after application has thoroughly dried. Remove protective covering immediately before proceeding with work that will conceal the membrane waterproofing.

## 3.6 CLEAN UP

Use a cleaner recommended by the waterproofing manufacturer to clean other

work surfaces that are stained with waterproofing material.

### 3.7 SCHEDULE OF MATERIALS

Some metric measurements in this section are based on mathematical conversion of inch-pound measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

<u>Products</u>	<u>Inch-Pound</u>	<u>Metric</u>
Protection Board	1/2 inch	
	7/16 inch	
Polyethylene Sheet	30 lbs.	
Laminated Sheet	0.40 lbs. per sq. ft	
Copper Sheet	3 oz/sq ft	
	5 oz/sq ft	
	7 oz/sq ft	

-- End of Section --

## SECTION 07 13 53

## ELASTOMERIC SHEET WATERPROOFING

02/16, CHG 1: 08/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C1305	(2008) Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D146/D146M	(2004; E 2012; R 2012) Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
ASTM D297	(2015; R 2019) Rubber Products - Chemical Analysis
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D429	(2014) Rubber Property-Adhesion to Rigid Substrates
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D573	(2004; R 2019) Standard Test Method for Rubber - Deterioration in an Air Oven
ASTM D624	(2000; R 2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D746	(2014) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D751	(2006; R 2011) Coated Fabrics

ASTM D903	(1998; R 2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
ASTM D1004	(2013) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1149	(2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D1204	(2014; R 2020) Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
ASTM D1876	(2008; R 2015; E 2015) Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)
ASTM D2136	(2002; R 2012) Coated Fabrics - Low-Temperature Bend Test
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D3045	(1992; R 2010) Practice for Heat Aging of Plastics Without Load
ASTM D5385/D5385M	(1993; R 2014; E 2014) Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
ASTM E96/E96M	(2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E154/E154M	(2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Manufacturer's Standard Details; G[, [\_\_\_\_]]

Elastomeric Waterproofing Sheet Material; G[, [\_\_\_\_\_]]

Protection Board; G[, [\_\_\_\_\_]]

Primers, Adhesives, and Mastics; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Elastomeric Waterproofing Sheet Material; G[, [\_\_\_\_\_]]

Field Quality Control documentation; G[, [\_\_\_\_\_]]

Protective Covering; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Elastomeric Waterproofing Sheet Material; G[, [\_\_\_\_\_]]

Primers, Adhesives, and Mastics; G[, [\_\_\_\_\_]]

[ Protective Coverings; G[, [\_\_\_\_\_]]

] Draft Special Warranties; G[, [\_\_\_\_\_]]

Final Special Warranties; G[, [\_\_\_\_\_]]

Certificates Of Compliance; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Primers, Adhesives, and Mastics; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Certificates Of Compliance with sustainable requirements for items listed in SD-07; G[, [\_\_\_\_\_]]

### 1.3 MANUFACTURER'S DETAILS

Submit **manufacturer's standard details** indicating methods of attachment and spacing, transition and termination details, and installation details. Include verification of existing conditions.

### 1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for **protective coverings**, and manufacturer's Safety Data Sheets (SDS) for **primers, adhesives, and mastics**.

#### [1.5 CODE REQUIREMENTS

Provide membrane waterproofing system in accordance with **ICC IBC** Section 1805 Dampproofing and Waterproofing.

#### ]1.6 DELIVERY, STORAGE, HANDLING, IDENTIFICATION

Deliver and store materials in accordance with manufacturer's printed instructions, out of the weather, in manufacturer's original packaging with

brand name and product identification clearly marked. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Do not permit unidentified materials in the work area or in the project.

#### 1.7 ENVIRONMENTAL CONDITIONS

Do not apply waterproofing during inclement weather or when there is ice, frost, surface moisture, or visible dampness on the surface to receive waterproofing for when ambient and surface temperatures are 40 degrees F or below. [The restriction on the application of waterproofing materials when ambient and surface temperatures are below 40 degrees F will be waived if the Contractor devises a means, approved by the Contracting Officer in writing, of maintaining the surface and ambient temperatures above 40 degrees F.]

#### 1.8 SPECIAL WARRANTIES

##### 1.8.1 Guarantee

Guarantee waterproofing membrane installation against failure due to leaks for a period of two years from the date of Beneficial Occupancy. Submit draft and final guarantees in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS [and 01 78 23 OPERATION AND MAINTENANCE DATA].

##### 1.8.2 Warranty

Provide manufacturer's material warranty for all system components for a period of ten years from the date of Beneficial Occupancy. Submit draft and final warranties in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS [and 01 78 23 OPERATION AND MAINTENANCE DATA].

### PART 2 PRODUCTS

#### 2.1 SUSTAINABILITY CRITERIA

Where allowed by performance criteria:

##### 2.1.1 Reduced Volatile Organic Compound (VOC) Content

Provide products with reduced VOC content and provide [certificates of compliance](#) in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

##### 2.1.2 Recycled Content

Provide products with recycled content and provide [certificates of compliance](#) in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph RECYCLED CONTENT.

#### 2.2 MATERIALS

Provide one of the types of [elastomeric waterproofing sheet material](#) and related [primers, adhesives, and mastics](#) as specified herein. Ensure compatibility of waterproofing materials with each other, and with materials on which they are applied. Provide materials that comply with applicable requirements cited below when tested in accordance with the referenced ASTM publications.



## 2.3 BUTYL RUBBER SHEETING

Not less than 60 mils minimum thickness.

### 2.3.1 Butyl Rubber Sheeting Performance Requirements

- a. Thickness Tolerance, ASTM D412: Plus or minus 10 percent.
- b. Specific Gravity, ASTM D297: 1.20, plus or minus 0.05.
- c. Tensile Strength, ASTM D412: 1200 psi minimum.
- d. Tensile Stress at 300 percent elongation, ASTM D412: 600 psi minimum.
- e. Elongation, ASTM D412: 300 percent minimum.
- f. Tear Resistance, Die C, ASTM D624: 150 pound force per inch (lbf/inch) minimum.
- g. Shore A Hardness, ASTM D2240: 5-second interval before reading; 60 plus or minus 10.
- h. Ozone Resistance, ASTM D1149: No cracks, 7 days - 50 pphm - 100 degrees F, 20 percent elongation.
- i. Heating Aging-Accelerated, ASTM D573: Tensile retention, 60 percent of minimum original elongation retention; 60 percent of minimum original requirement; 7 days, 240 degrees F.
- j. Butyl Identification, ASTM D471 REV A, Tricresyl Phosphate Immersion: Maximum volume swell 10 percent, 70 hrs, 212 degrees F.
- k. Low Temperature Flexibility, ASTM D746: No failure at minus 40 degrees F.
- l. Water Absorption, ASTM D471 REV A: Plus 1 percent maximum. 7 days, 158 degrees F.
- m. Exposure to Fungi and Bacteria in Soil, ASTM E154/E154M REV A, Minimum 16 Weeks: Unaffected.
- n. Water Vapor Transmission, 80 degrees F Permeance, ASTM E96/E96M, Procedure B or BW: 0.15 perms maximum.

### 2.3.2 Adhesive, Cement, and Tape for Use with Butyl Rubber

As recommended by the butyl rubber waterproofing membrane manufacturer.

## 2.4 THERMOPLASTIC MEMBRANE: POLYVINYL CHLORIDE (PVC)

Polyvinyl chloride (PVC) flexible sheets with non-woven fiberglass reinforcing not less than 60 mils minimum thickness.

### 2.4.1 Thermoplastic Membrane Performance Requirements

- a. Overall thickness, ASTM D751: .059 inches minimum
- b. Tensile strength, ASTM D638: 1600 psi minimum

- c. Elongation at break, [ASTM D638](#): 250 percent minimum
- d. Seam strength, [ASTM D638](#): 90 percent minimum of tensile strength
- e. Retention of properties after heat aging, [ASTM D3045](#)
- f. Tensile strength, [ASTM D638](#): 95 percent of original
- g. Elongation, [ASTM D638](#): 95 percent of original
- h. Tear resistance, [ASTM D1004](#): 17 lbf
- i. Low Temperature Bend, [ASTM D2136](#): minus 40 degrees F
- j. Liner Dimensional Change, [ASTM D1204](#): 0.002 percent
- k. Weight Change After Immersion in Water, [ASTM D570](#): 2.0 percent maximum

#### 2.4.2 Adhesives

- a. Adhesive for thermoplastic flashings as recommended by manufacturer.
- b. Adhesive for Sub-Membrane Grid: 100 percent solids, two part urethane, with minimum tensile strength of 150 psi, in accordance with [ASTM D412](#) and adhesion to concrete of 12 ply in accordance with [ASTM D429](#) as recommended by manufacturer.

#### 2.4.3 Accessories

Securement Strip: 14 gauge stainless steel metal bar 1 inch wide, pre-punched 1 inch on center for securement.

### 2.5 COMPOSITE, SELF-ADHERING MEMBRANE SHEETING

Cold applied composite sheet consisting of rubberized asphalt and cross laminated, high density polyethylene film. Not less than 60 mils minimum thickness is required.

#### 2.5.1 Composite, Self-Adhering Sheeting Performance Requirements

- a. Tensile Strength [ASTM D412](#), Die C: 250 psi minimum.
- b. Ultimate Elongation, [ASTM D412](#), Die C: 200 percent minimum.
- c. Water Vapor Transmission, [ASTM E96/E96M](#) 80 degrees F Permeance, Procedure B: 0.1 perm maximum.
- d. Pliability degrees, [ASTM D146/D146M](#): (180 degrees Bend Over 1 Inch Mandrel): No cracks at minus minus 25 degrees F.
- e. Provide test report data for crack bridging ability: Either in accordance with [ASTM C1305](#) as modified for a dry film thickness specified by the manufacturer and conducted at low temperature; or in accordance with a cycling over crack test also conducted for the specified dry film thickness at low temperature. Using either test, verify crack bridging up to 1/4 inch without damage to the membrane system.

- f. Puncture Resistance, [ASTM E154/E154M](#) REV A: 40 lb minimum.
- g. Lap Adhesion at Minimum Application Temperature, [ASTM D1876](#) Modified, 5 lbs/in..
- h. Peel Strength, [ASTM D903](#): Modified 9 lbs/in.
- i. Resistance to Hydrostatic Head, [ASTM D5385/D5385M](#): 231 ft of water.
- j. Water Absorption, [ASTM D570](#); 0.1 percent maximum.

#### 2.5.2 Primers

Asphalt composition, [ASTM D41/D41M](#), or synthetic polymer in solvent as recommended by the membrane manufacturer.

#### 2.5.3 Mastics

Polymer modified asphalt in suitable solvent of trowel grade consistency and as recommended by the membrane manufacturer.

#### 2.6 Protection Board

[ Provide protection board that is compatible with the waterproofing membrane. Use a minimum [1/2 inch](#) thick fir bitumen impregnated board [1 inch](#) for polystyrene [1/8 inch](#) thick for vertical and [1/4 inch](#) for horizontal premolded bituminous protection board as recommended by the manufacturer.

] [Three dimensional, high impact resistant polymeric grid with woven monofilament drainage fabric bonded to the grid.

### ]PART 3 EXECUTION

#### 3.1 VERIFICATION OF CONDITIONS

Before starting the work, verify surfaces that must be waterproofed are in satisfactory condition. Notify the Contracting Officer of defects or conditions anticipated to prevent a satisfactory application. Do not start application until defects and conditions have been corrected.

#### 3.2 SURFACE PREPARATION

Ensure surfaces to receive treatment are clean, dry, smooth, and free from deleterious materials and projections. [Thoroughly wet holes, joints, cracks, and voids in [masonry] [concrete] with water and fill with Portland cement mortar, strike flush, and permit to dry.] Cut off high spots or grind smooth. Finish top surfaces of projecting masonry or concrete ledges below grade, except footings, to a steep bevel with Portland cement mortar. Sweep surfaces to receive covering before applying waterproofing to remove dust and foreign matter. Cure concrete by a method compatible with the waterproofing system.

#### 3.3 APPLICATION

##### 3.3.1 Building Envelope Requirements

Provide a continuous waterproofing system at all material and building transitions. Lap, wrap, fasten and seal products in accordance with manufacturer's printed instructions. Envelope assembly variations are not

permitted without written approval from the Contracting Officer's Representative.

### 3.3.2 General Installation Requirements

Provide sheet waterproofing in accordance with manufacturer's printed installation instructions. Ensure the surface to receive membrane is clean, smooth and dry without surface irregularities; correct deficiencies prior to installation. [Where indicated, mop continuous cant strips in place at vertical and horizontal corners before installing the waterproofing membrane. Do not use untreated wood or wood fiber cants.] When using solvent welding liquid, avoid prolonged contact with skin and breathing of vapor and provide adequate ventilation. Carry waterproofing of horizontal surfaces up abutting vertical surfaces and adhere solid to the substrate. Avoid wrinkles and buckles in applying membrane and joint reinforcement.

#### 3.3.2.1 Non-Self-Adhering Membrane

Unroll membrane and allow to remain flat for at least one-half hour before application. Apply an asphalt concrete primer prior to application of asphaltic adhesive. Where solvent adhesive is applied, allow major portion of solvent to evaporate so that bonding adhesive does not stick to a dry finger touching it. Apply elastomeric waterproofing membrane in a full bed of adhesive at a uniform coverage rate in accordance with the membrane manufacturer's printed instructions. [Where membrane on horizontal surfaces are to receive concrete fill, apply adhesive in 4 inch wide strips at 2 feet on center.] Pull membrane tight without stretching. As soon as adhesive is fully set and dry, recheck lap splices. Where openings or fishmouths appear, reseal and reroll lap splices.

#### 3.3.2.2 Self-Adhering Membrane

Apply composite, self-adhering membrane on surfaces primed at a uniform coverage rate in accordance with membrane manufacturer's printed instructions. Remove release sheet and apply with tacky surface in contact with dried primer.

#### 3.3.2.3 Protection

Protect membrane over horizontal surfaces from traffic during installation. Use only equipment with rubber tires. Provide walkway protection where heavy traffic from other trades is expected. Do not store material on membrane.

#### 3.3.3 Butyl Rubber

Lap sheets at sides and ends a minimum of 6 inches over the preceding sheet. Apply lap splicing cement over entire 6 inches splice area prior to application of sealant. Make sealant continuous along the entire length of the splice. Maintain a continuous bead of sealant at all membrane splices or as required by the manufacturer. Provide a tongue and groove cemented splice a minimum of 6 inches wide with factory made heat vulcanized seam of not less than 2 inches or as required by the manufacturer, when membrane is below water table.

#### 3.3.4 Thermoplastic Membrane (PVC)

Consult with membrane manufacturer prior to grid application. Install 12

inches wide sub-membrane containment grid as required by manufacturer. Provide the containment grid at intervals across the width and length of the substrate, at the base of all transitions, walls, curbs, penetrations, and at the perimeter of each deck/substrate section. Fully adhere strips to the deck in a full bedding of two-part urethane adhesive. Weld adjacent sheets in accordance with manufacturer's instructions. Hot-air weld all side and end lap joints. Provide lap area a minimum of 3 inch wide when machine welding, and a minimum of 4 inch wide when hand welding but not less than recommended by the manufacturer. Orient overlaps with the direction of flow of water.

#### 3.4 COMPOSITE, SELF-ADHERING MEMBRANE

Lap sheets at edges and ends a minimum of 2-1/2 inches over the preceding sheet. Provide all side laps a minimum 2-1/2 inches and end laps 5 inches. Provide self-adhesive, mastic laps in accordance with manufacturer's recommendation. Roll or firmly press to adhere membrane to substrate. Cover corners and joints with two layers of reinforcement by first applying a 12 inch width of membrane centered along the axis. Flash drains and projections with a second ply of membrane for a distance of 6 inches from the drain or projection. Finish exposed, terminated edges of membrane on horizontal or vertical surfaces with a toweled bead of mastic. Apply mastic around edges of membrane, and drains and projections. Apply mastic at end of each work day.

#### 3.5 FLASHING

Flash penetrations through membrane. Seal all penetrations where reinforcing bars penetrate a waterproofing membrane with the appropriate sealant or mastic flashing component. Embed elastomeric membrane in a heavy coat of adhesive, except for self-adhering membrane. Position continuous metal reglets horizontally on footing and vertically on intersecting and connecting walls, and as specified in Section 07 60 00 FLASHING AND SHEET METAL. Metal reglets are to receive exposed edges of membrane waterproofing. Secure membrane into reglets by lead wedges and fill with cement as recommended in writing by manufacturer of waterproofing materials. Counterflash upper edge of membrane waterproofing and protective covering as specified in Section 07 60 00 FLASHING AND SHEET METAL.

#### 3.6 FIELD QUALITY CONTROL

Notify the Contracting Officer 5 working days prior to date of performing tests. Before concealment, cover elastomeric waterproofing on horizontal surfaces over finished spaces with [3] [4] inches of ponded water for 24 hours. Do not add water after start of 24 hour period. Accurately measure water level at beginning and end of 24 hour period. If water level falls, remove water and inspect waterproofing membrane. Make repairs or replacement as directed, and repeat test. Do not proceed with work that conceals membrane waterproofing before receiving approval and acceptance of the Contracting Officer.

#### 3.7 PROTECTIVE COVERING

After installation has been inspected and approved by the Contracting Officer, apply a protective covering to the membrane waterproofing prior to backfilling. Protect vertical membrane waterproofing with a 1/2 inch minimum thickness of asphalt plank; 1/2 inch minimum thickness of fiberboard; or 1/8 inch minimum thickness of compatible water resistant bitumen type protection board with edges abutting adjacent edges and

exposed surfaces covered by a taping system recommended by manufacturer of protection board. Cover horizontal membrane waterproofing with similar protection board and Portland cement mortar not less than 3/4 inch thick; place uniformly and allow to set before installing subsequent construction.

-- End of Section --

## SECTION 07 14 00

## FLUID-APPLIED WATERPROOFING

02/12, CHG 2: 02/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C836/C836M	(2018; R 2022) Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Fluid-Applied Membrane

Membrane Primer

Elastomeric Sheet

Flexible Foam-Backed Elastomeric Sheet

Solvent

Moisture Meter

Protection Board

Bond Breaker

Submit material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.

#### SD-11 Closeout Submittals

Warranty

Information Card

Instructions To Government Personnel

Include copies of Safety Data Sheets for maintenance/repair materials.

### 1.3 PREWATERPROOFING CONFERENCE

Prior to starting application of waterproofing system, arrange and attend a prewaterproofing conference to ensure a clear understanding of drawings and specifications. Give the Contracting Officer 7 days advance written notice of the time and place of meeting. Ensure that the mechanical and electrical subcontractor, flashing and sheetmetal subcontractor, and other trades that may perform other types of work on or over the membrane after installation, attend this conference.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver waterproofing materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by a referenced specification number shall bear the specification number, type, and class of the contents. Deliver materials in sufficient quantity to continue work without interruption. Store and protect materials in accordance with manufacturer's instructions, and use within their indicated shelf life. When hazardous materials are involved, adhere to special precautions of the manufacturer, unless precautions conflict with local, state, and federal regulations. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture or freezing. Store materials on pallets and cover from top to bottom with canvas tarpaulins.

### 1.5 ENVIRONMENTAL CONDITIONS

Apply materials when ambient temperature is 40 degrees F or above for a period of 24 hours prior to the application and when there is no ice, frost, surface moisture, or visible dampness on the substrate surface. Apply materials when air temperature is expected to remain above 40 degrees F during the cure period recommended by the manufacturer. Moisture test for substrate is specified under paragraph entitled "Moisture Test." Work may be performed within heated enclosures, provided the surface temperature



of the substrate is maintained at a minimum of 40 degrees F for 24 hours prior to the application of the waterproofing, and remains above that temperature during the cure period recommended by the manufacturer.

#### 1.6 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revisions or amendment to standard membrane manufacturer warranty to comply with the specified requirements. Minimum manufacturer warranty shall have no dollar limit, cover full system water-tightness, and shall have a minimum duration of 20 years.

##### 1.6.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. Write the warranty directly to the Government commencing at time of Government's acceptance of the roof work. Provide the the following statements for such warranty:

- a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, cracks, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All cost associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.
- b. The warranty must remain in full force and effect, including emergency temporary repairs performed by others, when the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification.

##### 1.6.2 Roofing System Installer Warranty

The roof system installer must warrant for a minimum period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

##### 1.6.3 Continuance of Warranty

Approve repair or replacement work that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

## PART 2 PRODUCTS

## 2.1 FLUID-APPLIED MEMBRANE

ASTM C836/C836M.

## 2.2 MEMBRANE PRIMER

As recommended by the fluid-applied membrane manufacturer unless specifically prohibited by the manufacturer of the fluid-applied membrane.

## 2.3 SEALANT

As specified in Section 07 92 00 JOINT SEALANTS.

## 2.4 SEALANT PRIMER

As specified in Section 07 92 00 JOINT SEALANTS.

## 2.5 BACKING MATERIAL

Premolded, closed-cell, polyethylene, or polyurethane foam rod having a diameter 25 percent larger than joint width before being compressed into joint. Provide bond breaker of polyethylene film or other suitable material between backing material and sealant.

## [2.6 JOINT FILLER

As specified in [Section 03 30 00 CAST-IN-PLACE CONCRETE,] [ASTM D1751]  
[or] [ASTM D1752].

## ]2.7 BOND BREAKER

As recommended by the fluid-applied membrane manufacturer. Bond breaker shall not interfere with the curing process or other performance properties of the fluid-applied membrane.

## 2.8 ELASTOMERIC SHEET

Preformed; as recommended by the fluid-applied membrane manufacturer. Bond strength between the fluid-applied membrane and the preformed elastomeric sheet shall be a minimum of one psi when tested in accordance with ASTM C836/C836M.

## 2.9 ELASTOMERIC SHEET ADHESIVE

As recommended by the elastomeric sheet manufacturer.

## 2.10 FLEXIBLE FOAM-BACKED ELASTOMERIC SHEET

Flexible foam-backed elastomeric sheet for protection over preformed elastomeric sheet at expansion joints shall be 1/2 inch thick, minimum, closed cell foam conforming to ASTM D1056, Type 2, Class B, Grades 2 or 3, factory-bonded to 1/16 inch thick, minimum, preformed elastomeric sheet.

## 2.11 PROTECTION BOARD

Premolded bitumen composition board, 1/8 inch minimum thickness or other composition board compatible with the fluid-applied membrane.

## 2.12 DRAINAGE COURSE AGGREGATE

ASTM C33/C33M, size No. 8.

## 2.13 INSULATION

Polystyrene foam conforming to ASTM C578, Class IV, thickness as [indicated] [required by indicated R-value].

## PART 3 EXECUTION

### 3.1 PREPARATION

Coordinate work with that of other trades to ensure that components to be incorporated into the waterproofing system are available when needed. Inspect and approve surfaces immediately before application of waterproofing materials. Remove laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, and other contaminants which could adversely affect the complete bonding of the fluid-applied membrane to the concrete surface.

#### 3.1.1 Flashings

Make penetrations through sleeves in concrete slab watertight before application of waterproofing. After flashing is completed, cover elastomeric sheet with fluid-applied waterproofing during waterproofing application.

##### 3.1.1.1 Drains

Make drain flanges flush with surface of structural slab. Apply a full elastomeric sheet around the drain, with edges fully adhered to drain flange and to structural slab. Do not adhere elastomeric sheet over joint between drain and concrete slab. Do not plug drainage or weep holes. Cover elastomeric sheet with fluid-applied waterproofing during waterproofing application. Lap elastomeric sheet a minimum of 4 inches onto concrete slab.

##### 3.1.1.2 Penetrations and Projections

Flash penetrations and projections through structural slab with an elastomeric sheet adhered to the concrete slab and the penetration. Leave elastomeric sheet unadhered for one inch over joint between penetration and concrete slab. Adhere elastomeric sheet a minimum of 4 inches onto horizontal deck.

##### 3.1.1.3 Walls and Vertical Surfaces

Flash wall intersections which are not of monolithic pour or constructed with reinforced concrete joints with an elastomeric sheet adhered to both vertical wall surfaces and concrete slab. Flash intersections which are monolithically poured or constructed with reinforced concrete joints with either an elastomeric sheet or a vertical grade of fluid-applied waterproofing adhered to vertical wall surfaces and concrete slab. Leave sheet unadhered for a distance of one inch from the corner on both vertical and horizontal surfaces.

#### 3.1.2 Cracks and Joints

Prepare visible cracks and joints in substrate to receive fluid-applied

waterproofing membrane by placing a bond breaker and an elastomeric slip sheet between membrane and substrate. Cracks that show movement shall receive a 2 inch bond breaker followed by an elastomeric sheet adhered to the deck. Nonmoving cracks shall be double coated with fluid-applied waterproofing.

### 3.1.3 Priming

Prime surfaces to receive fluid-applied waterproofing membrane. Apply primer as required by membrane manufacturer's printed instructions.

## 3.2 SPECIAL PRECAUTIONS

Protect waterproofing materials during transport and application. Do not dilute primers and other materials, unless specifically recommended by materials manufacturer. Keep containers closed except when removing contents. Do not mix remains of unlike materials. Thoroughly remove residual materials before using application equipment for mixing and transporting materials. Do not permit equipment on the project site that has residue of materials used on previous projects. Use cleaners only for cleaning, not for thinning primers or membrane materials. Ensure that workers and others who walk on cured membrane wear clean, soft-soled shoes to avoid damaging the waterproofing materials.

## 3.3 APPLICATION

Over primed surfaces, provide a uniform, wet, monolithic coating of fluid-applied membrane, 60 mils thick, plus or minus 5 mils by following manufacturer's printed instructions. Apply material by trowel, squeegee, roller, brush, spray apparatus, or other method recommended by membrane manufacturer. Check wet film thickness as specified in paragraph entitled "Film Thickness" and adjust application rate as necessary to provide a uniform coating of the thickness specified. Where possible, mark off surface to be coated in equal units to facilitate proper coverage. At expansion joints, control joints, prepared cracks, flashing, and terminations, carry membrane over preformed elastomeric sheet in a uniform 60 mil thick, plus or minus 5 mils, wet thickness to provide a monolithic coating. If membrane cures before next application, wipe previously applied membrane with a solvent to remove dirt and dust that could inhibit adhesion of overlapping membrane coat. Use solvent recommended by the membrane manufacturer, as approved.

### 3.3.1 Work Sequence

Perform work so that protection board is installed prior to using the waterproofed surface. Do not permanently install protection board until the membrane has passed the flood test specified under paragraph entitled "Flood Test." Move material storage areas as work progresses to prevent abuse of membrane and overloading of structural deck.

### 3.3.2 Protection Board

Protect fluid-applied membrane by placing protection board over membrane at a time recommended by the membrane manufacturer. Protect membrane application when protection board is not placed immediately. Butt protection boards together and do not overlap.

### 3.3.3 Drainage Course

Place drainage course where shown after flood tests are completed and concrete protection slab or wearing course is ready to be installed.

#### 3.3.4 Insulation

Place insulation of thickness indicated, on top of drainage course just prior to placement of concrete protection slab.

### 3.4 FIELD QUALITY CONTROL

#### 3.4.1 Moisture Test

Prior to application of fluid-applied waterproofing, measure moisture content of substrate with a [moisture meter](#) in the presence of the Contracting Officer. Do not begin application until meter reading indicates "dry" range.

#### 3.4.2 Film Thickness

Measure wet film thickness every [100 square feet](#) during application by placing flat metal plates on the substrate or using a mil-thickness gage especially manufactured for the purpose.

#### 3.4.3 Flood Test

After application and curing is complete, plug drains and fill waterproofed area with water to a depth of [2 inches](#). A minimum 48 hour cure time, or longer cure time if recommended by the membrane manufacturer, shall be required prior to flood testing. Allow water to stand 24 hours. Test watertightness by measuring water level at beginning and end of the 24 hour period. If water level falls, drain water, allow installation to dry, and inspect. Make repairs or replace as required and repeat the test. Work shall not proceed before approval of repairs or replacement.

### 3.5 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the roof membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

### 3.6 INFORMATION CARD

For each roof application, furnish a minimum [8-1/2 inch by 11 inch](#) information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved [0.032 inch](#) thick aluminum card for exterior display. Identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contract information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.



FORM 1	
FLUID-APPLIED WATERPROOFING SYSTEM COMPONENTS	
1.	Contract Number
2.	Date Work Completed
3.	Project Specification Designation
4.	Substrate Material
5.	Slope of Substrate
6.	Drains Type/Manufacturer
7.	Waterproofing
	a. Membrane
	b. Sealant
	c. Elastomeric Sheet
	d. Materials Manufacturer(s)
8.	Protection Board
	a. Type
	b. Thickness
	c. Manufacturer's Name
9.	Drainage Course Material Graduation
10.	Insulation
	a. Type
	b. Thickness
	c. Manufacturer's Name
11.	Protection Slab
	a. Material
	b. Thickness
	c. Support
	d. Joint System

FORM 1	
FLUID-APPLIED WATERPROOFING SYSTEM COMPONENTS	
12. Wearing Course	
a. Type	
b. Slope	
c. Joint System	
d. Sealant/Gasket Type	
13. Wearing Surface Type	
Manufacturer's Name	
14. Warranty	
a. Manufacturer warranty expiration	
b. Warranty reference number	
15. Statement of Compliance or Exception	
Contractor's Signature	Date Signed
Inspector's Signature	Date Signed

-- End of Section --



## SECTION 07 19 00

WATER REPELLENTS  
05/11, CHG 1: 08/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

**AAMA 501.1** (2017) Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

**AASHTO T 259** (2002; R 2017) Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration

**AASHTO T 260** (1997; R 2016) Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

## ASTM INTERNATIONAL (ASTM)

**ASTM C140/C140M** (2022a) Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

**ASTM C642** (2021) Standard Test Method for Density, Absorption, and Voids in Hardened Concrete

**ASTM C672/C672M** (2012) Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals

**ASTM D1653** (2013) Water Vapor Transmission of Organic Coating Films

**ASTM D2369** (2010; R 2015; E 2015) Volatile Content of Coatings

**ASTM D3278** (1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus

**ASTM E96/E96M** (2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials

**ASTM E514/E514M** (2020) Standard Test Method for Water Penetration and Leakage Through Masonry

ASTM G154

(2016) Standard Practice for Operating  
Fluorescent Light Apparatus for UV  
Exposure of Nonmetallic Materials

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000

Air Contaminants

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-03 Product Data

Water Repellents

### SD-06 Test Reports

Water Absorption

Accelerated Weathering

Resistance to Chloride Ion Penetration

Moisture Vapor Transmission

Scaling Resistance

Water Penetration and Leakage

### SD-07 Certificates

Manufacturer's Qualifications

Applicator's Qualifications

Evidence of Acceptable Variation

Warranty

### SD-08 Manufacturer's Instructions

Application Instructions

Provide manufacturer's instructions including preparation, application, recommended equipment to be used, safety measures, and protection of completed application.

Manufacturer's Safety Data Sheets

## 1.3 QUALITY ASSURANCE

### 1.3.1 Qualifications

- a. **Manufacturer's qualifications:** Minimum five years record of successful in-service experience of water repellent treatments manufactured for [concrete,] [concrete masonry,] [plaster] application.
- b. **Applicator's qualifications:** Minimum five years successful experience in projects of similar scope using specified or similar treatment materials and manufacturer's approval for application.

#### 1.3.2 Performance Requirements

- a. **Water absorption:** **ASTM C140/C140M.** Comparison of treated and untreated specimens.
- b. **Moisture vapor transmission:** **ASTM E96/E96M.** Comparison of treated and untreated specimens.
- c. **Water penetration and leakage through masonry:** **ASTM E514/E514M.**

#### 1.3.3 Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Contracting Officer, evidence that the proposed product is either equal to or better than the product specified. Include the following:

- a. Identification of the proposed substitution;
- b. Reason why the substitution is necessary;
- c. A comparative analysis of the specified product and the proposed substitution, including tabulations of the composition of pigment and vehicle;
- d. The difference between the specified product and the proposed substitution; and
- e. Other information necessary for an accurate comparison of the proposed substitution and the specified product.

#### 1.4 SAMPLE TEST PANEL

The approved Sample Test Panel will serve as the standard of quality for all other water repellent coating work. Do not proceed with application until the sample panel has been approved by the Contracting Officer.

##### 1.4.1 Sample Test Panel

Prior to commencing work, including bulk purchase and delivery of material, apply water repellent treatment to a minimum **4 feet** high by **4 feet** long [concrete,] [concrete masonry,] [plaster] test-panel specified in [\_\_\_\_]. Provide a full height expansion joint at mid-panel length. Prepare and seal joint with materials approved for project use.

##### 1.4.1.1 Testing

**AAMA 501.1** Provide field water testing of water repellent treated surfaces in the presence of the Contracting Officer and the water repellent treatment manufacturer's representative.

- a. Apply water repellent to left side of mock-up and allow to cure prior to application of treatment to right side.
- b. Twenty days after completion of application of treatment, test mock-up with 5/8 inch garden hose, with spray nozzle, located 10 feet from wall and aimed upward so water strikes wall at 45 degree downward angle. After water has run continuously for three hours observe back side of mock-up for water penetration and leakage. If leakage is detected make changes as needed and retest.
- c. Coordinate testing procedures and modify project treatment application as required to pass mock-up tests for water penetration and leakage resistance.

#### 1.4.1.2 Approval

Proceed with water repellent treatment work only after completion of field test application and approval of mock-up and tests by the Contracting Officer.

#### 1.4.2 Pre-Installation Meeting

- a. Attend pre-installation meeting required prior to commencement of [concrete,] [concrete masonry,] [plaster] installation.
- b. Review procedures and coordination required between water repellent treatment work and work of other trades which could affect work to be performed under this section of the work.
- c. Convene additional pre-installation meeting prior to water repellent treatment application for coordination with work not previously coordinated including joint sealants.

### 1.5 REGULATORY REQUIREMENTS

#### 1.5.1 Environmental Protection

In addition to requirements specified in Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for environmental protection, provide coating materials that conform to the restrictions of the [Local Air Pollution Control jurisdiction] [CALIFORNIA AIR RESOURCES BOARD (CARB) and local Air Pollution Control District regional jurisdiction]. Notify the Contracting Officer of any water repellent coating specified herein which fails to conform to the local Air Quality Management District Rules at the location of the Project. In localities where the specified coating is prohibited, the Contracting Officer may direct the substitution of an acceptable coating.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original sealed containers, clearly marked with the manufacturer's name, brand name, type of material, batch number, percent solids by weight and volume, and date of manufacturer. Store materials off the ground, in a dry area where the temperature will be not less 50 degrees F nor more than 85 degrees F.

#### 1.7 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance

with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, and the following:

#### 1.7.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The coating manufacturer when using solvents or other chemicals. Use impermeable gloves, chemical goggles or face shield, and other recommended protective clothing and equipment to avoid exposure of skin, eyes, and respiratory system. Conduct work in a manner to minimize exposure of building occupants and the general public.
- b. 29 CFR 1910.1000.
- c. Threshold Limit Values (R) of the American Conference of Governmental Industrial Hygienists.
- d. Manufacturer's Safety Data Sheets.

#### 1.8 ENVIRONMENTAL CONDITIONS

##### 1.8.1 Weather and Substrate Conditions

Do not proceed with application of water repellents under any of the following conditions, except with written recommendations of manufacturer.

- a. Ambient temperature is less than 40 degrees F.
- b. Substrate faces have cured less than one month.
- c. Rain or temperature below 40 degrees F are predicted for a period of 24 hours before or after treatment.
- d. Earlier than three days after surfaces are wet.
- e. Substrate is frozen or surface temperature is less than 40 degrees F and falling.

##### 1.8.2 Moisture Condition

Determine moisture content of substrate meets manufacturer's requirements prior to application of water repellent material.

#### 1.9 SEQUENCING AND SCHEDULING

##### 1.9.1 Masonry Surfaces

Do not start water repellent coating until all joint tooling, pointing and masonry cleaning operations have been completed. Allow masonry to cure for at least 60 days under normal weather conditions before applying water repellent.

##### 1.9.2 Plaster Surfaces

Do not start water repellent coating until all shrinkage and stress cracks are repaired and sound, all surfaces are free of defects and cleaning operations have been completed. Allow plaster to cure for at least 30 days under normal weather conditions before applying water repellent.

### 1.9.3 Concrete Surfaces

Do not start water repellent coating until all patching, pointing and cleaning operations have been completed and concrete has cured a minimum of 30 days under normal weather conditions.

### 1.9.4 Sealants

Do not apply water repellents until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.

- a. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- b. Provide manufacturers' test results of compatibility.

### 1.10 INSPECTIONS

Notify the manufacturer's representative a minimum of 72 hours prior to scheduled application of water repellents for field inspection. Inspect surfaces and obtain approval in writing from the manufacturer's representative prior to any application of any water repellent coating.

### 1.11 SURFACES TO BE COATED

Coat all exterior [concrete,] [masonry,] [or plaster] surfaces. This includes back faces of parapets, top of walls, edges and returns adjacent to windows and door frames and free standing walls.

### 1.12 WARRANTY

Provide a warranty, issued jointly by the manufacturer and the applicator of the water repellent treatment against moisture penetration through the treated structurally sound surface for a period of five years. Warranty to provide the material, labor, and equipment necessary to remedy the problem. At the satisfactory completion of the work, complete the warranty sign, notarize, and submit to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Water repellent solution shall be a clear, non-yellowing, deep-penetrating, VOC compliant solution. Material shall not stain or discolor and shall produce a mechanical and chemical interlocking bond with the substrate to the depth of the penetration.

### 2.2 WATER REPELLENTS

#### 2.2.1 Silane, 20 Percent Solids

Penetrating water repellent. A monomeric compound containing approximately 20 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water, and other proprietary solvent carrier.

- a. Composition: Modified alkylalkoxysilane.

- b. Active alkylalkoxysilane content: [ASTM D2369](#) 20 percent by weight, plus or minus 1 percent.
- c. Appearance: White, milky liquid.
- d. Average depth of penetration: Up to [3/8 inch](#) depending on substrate.
- e. VOC content: Less than 350 grams per liter.
- f. Flash point, [ASTM D3278](#).
- g. Specific gravity, at [78 degrees F](#): 0.96 to 0.98.
- h. Density: [.0 to 8.2 pounds per gallon](#).

#### 2.2.2 Silane, 40 Percent Solids

Penetrating water repellent. A monomeric compound containing approximately 40 percent alkyltrialkoxysilanes with alcohol, mineral spirits, or water.

- a. Composition: Modified alkylalkoxysilane.
- b. Active alkylalkoxysilane content: [ASTM D2369](#) 40 percent by weight, plus or minus 1.5 percent.
- c. Appearance: White, milky liquid.
- d. Average depth of penetration: Up to [3/8 inch](#) depending on substrate.
- e. VOC content: Less than 350 grams per liter.
- f. Flash point, [ASTM D3278](#).
- g. Specific gravity, at [78 degrees F](#): 0.94 to 0.97.
- h. Density: [7.8 to 8.1 pounds per gallon](#).

#### 2.2.3 Silane, 85 Percent Solids or Greater

Penetrating water repellent. A monomeric compound containing 85 percent or greater alkyltrialkoxysilanes with alcohol, mineral spirits, or water.

- a. Composition: Modified alkylalkoxysilane.
- b. Active alkylalkoxysilane content: [ASTM D2369](#) 20 percent by weight, plus or minus 1 percent.
- c. Appearance: White, milky liquid.
- d. Average depth of penetration: Up to [3/8 inch](#) depending on substrate.
- e. VOC content: Less than 350 grams per liter.
- f. Flash point, [ASTM D3278](#).
- g. Specific gravity, at [78 degrees F](#): 0.96 to 0.98.
- h. Density: [8.0 to 8.2 pounds per gallon](#).

#### 2.2.4 Siloxanes

Penetrating water repellent. Alkylalkoxysiloxanes that are oligomeric with alcohol, ethanol, mineral spirits, or water.

- a. Solids by weight: [ASTM D2369](#), 7.5 to 16.0 percent.
- b. Volatile Organic Content (VOC) after blending: Less than 175 grams per liter.
- c. Density, activated: [8.4 pounds per gallon](#), plus or minus one percent.
- d. Flash point, [ASTM D3278](#): Greater than [212 degrees F](#).

#### 2.2.5 Low-Solids Acrylic

Water-clear, breathing coating of acrylic resins, water-based, solvent-based, or acrylic emulsions solution containing less than 15 percent solids by volume.

#### 2.2.6 High-Solids Acrylic

Water-clear, breathing coating of acrylic resins, water-based, solvent-based, or acrylic emulsions solution containing 15 percent solids or more by volume.

#### 2.2.7 VOC-Complying Water Repellents

Products certified by the manufacturer that they comply with local regulations controlling use of volatile organic compounds (VOC's).

### 2.3 PERFORMANCE CRITERIA

#### 2.3.1 Silane, 20 Percent Solids

- a. [Water absorption](#) test: [ASTM C642](#) and [ASTM E514/E514M](#).
- b. [Moisture vapor transmission](#): [ASTM D1653](#), 28.33 perms or 51.61 percent maximum compared to untreated surfaces.
- c. [Scaling resistance](#): [ASTM C672/C672M](#), non-air-entrained concrete, zero rating, no scaling, 100 cycles treated concrete.
- d. [Resistance to chloride ion penetration](#): [AASHTO T 259](#) and [AASHTO T 260](#).
- e. Water penetration and leakage through masonry, [ASTM E514/E514M](#) percentage reduction of leakage: 97 percent minimum.
- f. Resistance to [accelerated weathering](#), [ASTM G154](#) testing 2,500 hours: No loss in repellency.
- g. Drying time under normal conditions: Four hours per [75 degrees F](#).

#### 2.3.2 Silane, 40 Percent Solids

- a. Average depth of penetration: [3/8 inches](#) depending on substrate
- b. [Resistance to chloride ion penetration](#), [AASHTO T 259](#) and [AASHTO T 260](#).



- c. [Water absorption](#) test, [ASTM E514/E514M](#): 0.42 percent per 48 hours; 1.2 percent per 50 days.
- d. [Moisture vapor transmission](#): [ASTM D1653](#), 28.33 perms or 51.61 percent maximum compared to untreated surfaces.
- e. [Scaling resistance](#), [ASTM C672/C672M](#), non-air-entrained concrete: Zero rating, no scaling, 100 cycles treated concrete.
- f. Resistance to [accelerated weathering](#), [ASTM G154](#). Testing 2,500 hours: No loss in repellency.
- g. Drying time under normal conditions: Four hours per [75 degrees F](#).

#### 2.3.3 Silane, 85 Percent Solids or Greater

- a. Average depth of penetration: [3/8 inches](#) depending on substrate.
- b. [Resistance to chloride ion penetration](#), [AASHTO T 259](#) and [AASHTO T 260](#).
- c. [Water absorption](#) test, [ASTM E514/E514M](#): 0.42 percent per 48 hours; 1.2 percent per 50 days.
- d. [Moisture vapor transmission](#): [ASTM D1653](#), 28.33 perms or 51.61 percent maximum compared to untreated surfaces.
- e. [Scaling resistance](#), [ASTM C672/C672M](#), non-air-entrained concrete: Zero rating, no scaling, 100 cycles treated concrete.
- f. Resistance to [accelerated weathering](#), [ASTM G154](#). Testing 2,500 hours: No loss in repellency.
- g. Drying time under normal conditions: Four hours per [75 degrees F](#).

#### 2.3.4 Siloxanes

- a. Dry time for recoat, if necessary: One to two hours depending on weather conditions.
- b. Penetration: [3/8 inch](#), depending on substrate.
- c. Water penetration and leakage through masonry, [ASTM E514/E514M](#), percentage reduction of leakage: 97.0 percent minimum.
- d. [Moisture vapor transmission](#), [ASTM E96/E96M](#): 47.5 perms or 82 percent maximum compared to untreated sample.
- e. Resistance to [accelerated weathering](#), [ASTM G154](#). Testing 2,500 hours: No loss in repellency.
- f. [Resistance to chloride ion penetration](#), [AASHTO T 259](#) and [AASHTO T 260](#).
- g. [Scaling resistance](#), [ASTM C672/C672M](#), non-air-entrained concrete: Zero rating, no scaling, 100 cycles treated concrete.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Examine [concrete], [plaster], or [masonry] surfaces to be treated to ensure that:

- a. All visible cracks, voids or holes have been repaired.
- b. All mortar joints in masonry are tight and sound, have not been re-set or misaligned and show no cracks or spalling.
- c. Moisture contents of walls does not exceed 15 percent when measured on an electronic moisture register, calibrated for the appropriate substrate.
- d. Concrete surfaces are free of form release agents, curing compounds and other compounds that would prevent full penetration of the water repellent material.

Do not start water repellent treatment work until all deficiencies have been corrected, examined and found acceptable to the Contracting Officer and the water repellent treatment manufacturer. Do not apply treatment to damp, dirty, dusty or otherwise unsuitable surfaces. Comply with the manufacturer's recommendations for suitability of surface.

### 3.2 PREPARATION

#### 3.2.1 Surface Preparation

Prepare substrates in accordance with water repellent treatment manufacturer's recommendation. Clean surfaces of dust, dirt, efflorescence, alkaline, and foreign matter detrimental to proper application of water repellent treatment.

#### 3.2.2 Protection

Provide masking or protective covering for materials which could be damaged by water repellent treatment.

- a. Protect glass, glazed products, and prefinished products from contact with water repellent treatment.
- b. Protect landscape materials with breathing type drop cloths: plastic covers are not acceptable.

#### 3.2.3 Compatibility

- a. Confirm treatment compatibility with each type of joint sealer within or adjacent to surfaces receiving water repellent treatment in accordance with manufacturer's recommendations.
- [b. When recommended by joint sealer manufacturer, apply treatment after application and cure of joint sealers. Coordinate treatment with joint sealers.]
- [c. Mask surfaces indicated to receive joint sealers which would be adversely affected by water repellent treatment where treatment must be applied prior to application of joint sealers.]

### 3.3 MIXING

Mix water repellent material thoroughly in accordance with the manufacturer's recommendations. Mix, in quantities required for that days work, all containers prior to application. Mix each container the same length of time.

### 3.4 APPLICATION

In strict accordance with the manufacturers written requirements. Do not start application without the manufacturer's representative being present or his written acceptance of the surface to be treated.

#### 3.4.1 Water Repellent Treatment

##### 3.4.1.1 Spray Application

Spray apply water repellent material to exterior [concrete,] [plaster,] [and masonry] surfaces using low-pressure airless spray equipment in strict accordance with manufacturer's printed application, instructions, and precautions. Maintain copies at the job site. Apply flood coat in an overlapping pattern allowing approximately 8 to 10 inch rundown on the vertical surface. Maintain a wet edge at all overlaps, both vertical and horizontal. Hold gun maximum 18 inches from wall.

##### 3.4.1.2 Brush or Roller Application

Brush or roller apply water repellent material only at locations where overspray would affect adjacent materials and where not practical for spray applications.

##### 3.4.1.3 Covered Surfaces

Coat all exterior [concrete,] [plaster,] [or masonry] surfaces including back faces of parapets, tops of walls, edges and returns adjacent to window and door frames, window sills, and free-standing walls.

##### 3.4.1.4 Rate of Application

Apply materials to exterior surfaces at the coverages recommended by the manufacturer and as determined from sample panel test. Increase or decrease application rates depending upon the surface texture and porosity of the substrate so as to achieve even appearance and total water repellency.

##### 3.4.1.5 Number of Coats

The sample panel test shall determine the number of coats required to achieve full coverage and protection.

##### 3.4.1.6 Appearance

If unevenness in appearance, lines of work termination or scaffold lines exist, or detectable changes from the approved sample panel occur, the Contracting Officer may require additional treatment at no additional cost to the Government. Apply any required additional treatment to a natural break off point.

### 3.5 CLEANING

Clean all runs, drips, and overspray from adjacent surfaces while the water repellent treatment is still wet in a manner recommended by the

manufacturer.

### 3.6 FIELD QUALITY CONTROL

Do not remove drums containing water repellent material from the job site until completion of all water repellent treatment and until so authorized by the Contracting Officer.

#### 3.6.1 Field Testing

**AAMA 501.1.** At a time not less than twenty days after completion of the water repellent coating application, subject a representative wall area of the building to the Navy Hose Stream Field Test similar to **AAMA 501.1** hose test to simulated rainfall for a period of three hours. Use a minimum 5/8 inch diameter hose and a fixed lawn sprinkler spray head which will direct a full flow of water against the wall. Place the sprinkler head so that the water will strike the wall downward at a 45 degree angle to the wall. If the inside of the wall shows any trace of moisture during or following the test, apply another coat of water repellent, at the manufacturer's recommended coverage rate to the entire building. Repeat testing and re-coating process until no moisture shows on the inside wall face. Accomplish any required work retesting and re-coating at no additional cost to the Government.

#### 3.6.2 Site Inspection

Inspect treatment in progress by manufacturer's representative to verify compliance with manufacturer instructions and recommendations.

-- End of Section --

## SECTION 07 21 13

## BOARD AND BLOCK INSULATION

02/16, CHG 2: 08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C165	(2007; R 2017) Standard Test Method for Measuring Compressive Properties of Thermal Insulations
ASTM C203	(2005; R 2012) Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C272/C272M	(2016) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
ASTM C552	(2022) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2021) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM C1289	(2022) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of

## Pressure-Sensitive Tapes

- ASTM D4397** (2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
- ASTM E84** (2020) Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM E96/E96M** (2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
- ASTM E136** (2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
- ASTM E154/E154M** (2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

## INTERNATIONAL CODE COUNCIL (ICC)

- ICC IBC** (2018) International Building Code

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 31** (2020) Standard for the Installation of Oil-Burning Equipment
- NFPA 54** (2021) National Fuel Gas Code
- NFPA 70** (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
- NFPA 211** (2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

- SCS** SCS Global Services (SCS) Indoor Advantage

## TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

- TAPPI T803 OM** (2010) Puncture Test of Container Board

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1910.134** Respiratory Protection

## UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-03 Product Data

Manufacturer's Standard Details; G[, [\_\_\_\_\_]]

Block or Board Insulation; G[, [\_\_\_\_\_]]

Vapor Retarder; G[, [\_\_\_\_\_]]

Pressure Sensitive Tape; G[, [\_\_\_\_\_]]

Protection Board or Coatings; G[, [\_\_\_\_\_]]

Accessories including sealants; G[, [\_\_\_\_\_]]

Recycled Content for Block or Board Insulation; S

### SD-07 Certificates

Block or Board Insulation; G[, [\_\_\_\_\_]]

Vapor Retarder; G[, [\_\_\_\_\_]]

Protection Board or Coating; G[, [\_\_\_\_\_]]

Draft Special Warranties; G[, [\_\_\_\_\_]]

Final Special Warranties; G[, [\_\_\_\_\_]]

Indoor Air Quality For Block Or Board Insulation; S

### SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

## 1.3 MANUFACTURER'S DETAILS

Submit manufacturer's standard details indicating methods of attachment and spacing, transition and termination details, and installation details. Include verification of existing conditions.

## 1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for protection board or coatings, and precautions for

flammability and toxicity. Include data to verify compatibility of sealants with insulation.

#### [1.5 CERTIFICATIONS

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification by other third-party programs. Provide current product certification documentation from certification body.

#### ]1.6 DELIVERY, STORAGE, AND HANDLING

##### 1.6.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

##### 1.6.2 Storage

Inspect materials delivered to the site for damage and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Comply with manufacturer's recommendations for handling, storage, and protection of materials before and during installation.

#### 1.7 SAFETY PRECAUTIONS

##### [1.7.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by the National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) and in accordance with [29 CFR 1910.134](#).

##### ]1.7.2 Other Safety Considerations

Comply with the safety requirements of [ASTM C930](#).

#### 1.8 SPECIAL WARRANTIES

##### 1.8.1 Guarantee

Guarantee insulation installation against failure due to ultraviolet light exposure for a period of three years from the date of Beneficial Occupancy or Substantial Completion. Submit draft and final guarantees in accordance with Sections [01 78 00 CLOSEOUT SUBMITTALS](#) [and [01 78 23 OPERATION AND MAINTENANCE DATA](#)].

##### 1.8.2 Warranty

Provide manufacturer's material warranty for all system components for a period of three years from the date of Beneficial Occupancy or Substantial



Completion. Submit draft and final warranties in accordance with Sections 01 78 00 CLOSEOUT SUBMITTALS [and 01 78 23 OPERATION AND MAINTENANCE DATA].

## PART 2 PRODUCTS

### 2.1 BLOCK OR BOARD INSULATION

Provide thermal insulating materials as recommended by manufacturer for each type of application indicated. Provide insulation with the following physical properties and in accordance with the following standards:

- [ a. Cellular Glass: ASTM C552
- ] [b. Extruded Preformed Cellular Polystyrene: ASTM C578 REV A
- ] [c. Mineral Fiber Block and Board: ASTM C612
- ] [d. Unfaced Preformed Rigid Polyurethane and Polyisocyanurate Board: ASTM C591
- ] [e. Faced Rigid Cellular Polyisocyanurate and Polyurethane Insulation: ASTM C1289 REV A
- ] [ (1) Type I Aluminum Foil on both major surfaces. [Class 1 - Non-reinforced core foam.] [Class 2 - Glass fiber reinforced core.]
- ] [ (2) Type II Fibrous felt or glass fiber mat membrane on both major surfaces of the core foam.
- ] [ (3) Type III Perlite insulation board on one major surface of the core foam and a fibrous felt or glass fiber mat membrane on the other major surface of the core foam.
- ] [ (4) Type IV Cellulosic fiber insulating board on the one major surface of the core foam and fibrous felt or glass fiber mat membrane on the other major surface of the core foam.
- ] [ (5) Type V Oriented strand board or water board on one major surface of the core foam and fibrous felt or glass fiber mat membrane or aluminum foil on the other major surface of the core foam.
- ] [ (6) Type VI Perlite insulation board on both major surfaces of the core foam.

#### ] 2.1.1 Thermal Resistance

[ Unless otherwise indicated, Ceiling R-[\_\_\_\_\_] Wall R-[\_\_\_\_\_] Floor [R-\_\_\_\_\_] ].

#### ] 2.1.2 Fire Protection Requirements

- a. Flame spread index of 75 or less when tested in accordance with ASTM E84.
- b. Smoke developed index of [450] [200] [150] [\_\_\_\_\_] or less when tested in accordance with ASTM E84.
- c. Provide insulated assemblies in accordance ICC IBC Chapter Fire and Smoke Protection Features.

2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

- [ a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than [10] [\_\_\_\_\_] pounds per square inch (psi) when measured according to [ASTM D1621](#).
- ] [b. Mineral fiber board: Compressive strength: Minimum load required to produce a reduction in thickness of 10 percent pounds per square foot (lbf/sf): [25] [1000] when tested according to [ASTM C165](#).
- ] [c. Block-type insulation: Block-type insulation: Flexural strength: Not less than [25] [\_\_\_\_\_] psi when measured according to [ASTM C203](#) REV A.
- ] [d. Water Vapor Permeance: Not more than [1.1] [\_\_\_\_\_] Perms or less when measured according to [ASTM E96/E96M](#), desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.
- ] [e. Water Absorption: Not more than [2] [\_\_\_\_\_] percent by total immersion, by volume, when measured according to [ASTM C272/C272M](#).
- ] [f. Water Adsorption: Not more than [1] [\_\_\_\_\_] percent by volume when measured in accordance with paragraph 14 of [ASTM C553](#).

]2.1.4 Premolded Concrete Masonry Insert

Provide in accordance with [ASTM C578](#) REV A. Provide inserts in concrete masonry units that are installed at the masonry unit manufacturing plant. Provide insert with thickness of not less than 1 1/4 inches.

2.1.5 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum required recycled material contents (by weight, not volume) are:

Polyisocyanurate/Polyurethane:	9 percent
Phenolic Rigid Foam:	5 percent
Perlite Board:	75 percent post consumer paper

Provide data identifying percentage of [recycled content for block or board insulation](#).

2.1.6 Indoor Air Quality

Provide certification of [indoor air quality for block or board insulation](#).

2.1.7 Prohibited Materials

Do not provide materials containing asbestos.

## [2.2 VAPOR RETARDER AND DAMPPROOFING

### 2.2.1 Vapor Retarder in Framed Walls and Roofs

[ a. 6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 1 Perm or less when tested in accordance with ASTM E96/E96M.

] [b. Membrane with the following properties:

(1) Water Vapor Permeance: ASTM E96/E96M: [1] [\_\_\_\_\_] Perm

(2) Maximum Flame Spread: ASTM E84: [25] [50] [\_\_\_\_\_] ]

(3) Combustion Characteristics: Passing ASTM E136

(4) Puncture Resistance: TAPPI T803 OM: [15] [25] [50]

] [2.2.2 Dampproofing for Masonry Cavity Walls

[Bituminous material is specified in Section 07 11 13 BITUMINOUS DAMPPROOFING.] [Parging material is specified in Section 04 20 00 MASONRY.]

] [2.2.3 Vapor Retarder under Floor Slab

a. Water vapor permeance: 0.2 Perm or less when tested in accordance with ASTM E96/E96M.

b. Puncture resistance: Maximum load no less than 40 pounds when tested according to ASTM E154/E154M REV A.

] ] 2.3 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder(s). Match water vapor permeance rating for each vapor retarder specified. Provide tape in accordance with ASTM D3833/D3833M.

## 2.4 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

## 2.5 ACCESSORIES

### 2.5.1 Adhesive

As recommended by insulation manufacturer.

### 2.5.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

## PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

Prior to installation, ensure all areas that are in contact with the insulation are dry and free of projections that could cause voids,

compressed insulation, or punctured vapor retarders. For foundation perimeter or under slab applications, check that subsurface fill is flat, smooth, dry, and well tamped. Do not proceed with installation if moisture or other conditions are present, and notify the Contracting Officer of such conditions. Do not proceed with the work until conditions have been corrected and verified to be dry.

### 3.2 PREPARATION

#### 3.2.1 Blocking Around Heat Producing Devices

Provide noncombustible blocking at all spaces between heat producing devices and the floors, ceilings and roofs through which they pass. Provide in accordance with ICC IBC Section 2111.12 Fireplace Blocking and with the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is placed above fixture or device, 24 inches above fixture.
- b. Masonry chimneys or masonry enclosing a flue: 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.
- c. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.
- d. Gas Fired Appliances: Clearances as required in NFPA 54.
- e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified in writing by the chimney or flue manufacturer for use in contact with specific insulating materials.

### 3.3 INSTALLATION

#### 3.3.1 Installation and Handling

Provide insulation in accordance with the manufacturer's printed installation instructions. Keep material dry and free of extraneous materials.

#### 3.3.2 Electrical Wiring

Do not install insulation in a manner that would enclose electrical wiring between two layers of insulation.

#### [3.3.3 Cold Climate Requirement

Place insulation on the outside of pipes.

#### ]3.3.4 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation

at corners, wall to ceiling joint, roof, and floor. Avoid creating thermal bridges and voids. Provide and verify continuity of insulative barrier throughout the building enclosure.

### 3.3.5 Coordination

Verify final installed insulation thicknesses comply with thicknesses indicated, R-values specified herein, and with the approved insulation submittal(s).

## 3.4 INSTALLATION ON WALLS

### 3.4.1 Installation using Furring Strips

Install insulation [between] [on] members as recommended by insulation manufacturer.

### 3.4.2 Installation on Masonry Walls

[ Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Place boards in moderate contact with adjoining insulation without forcing and without gaps. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other utilities. Seal around cutouts with sealant. Install insulation in wall cavities so that it leaves at least a nominal 1 inch air space outside of the insulation to allow for cavity drainage.

] [Insert premolded or board insulation into masonry unit hollow cores as recommended by the insulation manufacturer.

### ] 3.4.3 Adhesive Attachment to Concrete and Masonry Walls

Apply adhesive to wall and completely cover wall with insulation.

[ a. Full back bed method [or]

] [b. Spot method: Provide at least six spots having diameter of approximately 4 inches, located at each corner and mid points of each of the longer sides of each board.

] [c. As recommended by the insulation manufacturer.

] d. Use only full back method for pieces of 1 square foot or less.

e. Butt all edges of insulation and seal edges with tape.

### 3.4.4 Mechanical Attachment on Concrete and Masonry Walls

Cut insulation to cover walls. Apply adhesive to wall and set clip or other mechanical fastener in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners and bend split prongs to provide a flush condition with the insulation. Butt all edges of insulation and seal with tape.

### [3.4.5 Protection Board or Coating

Install protection board or coating in accordance with manufacturer's

printed instructions. Install protection over all exterior exposed insulation and to 1 foot below grade.

] 3.5 INSTALLATION ON UNDERSIDE OF CONCRETE FLOOR SLAB

[3.5.1 Mechanically Fastened Systems

Size insulation to cover underside of slab. Apply adhesive to slab and set fasteners in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners and bend split prongs to provide a flush condition with the insulation. Butt all edges of insulation and seal with tape.

] [3.5.2 Adhesively Bonded Systems

Apply adhesive to underside of slab and completely cover wall with insulation.

[ a. Full back bed method [or]

] [b. Spot method: Provide at least six spots having a diameter of approximately 4 inches, located at each corner and mid-point of each of the longer sides.

] [c. As recommended by insulation manufacturer.

] d. Use full back method for insulation pieces 1 square foot or less.

e. Butt all edges of insulation and seal with tape.

] 3.6 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls, slab edges in slab-on-grade, or floating slab construction.

3.6.1 Manufacturer's Instructions

Layout insulation, tape edges, provide vapor retarder and other required accessories to protection against vermin, insects, and damage in accordance with manufacturer's printed instructions.

[3.6.2 Insulation on Vertical Surfaces

Provide thermal insulation [on exterior of foundation walls] [on grade beams] [partially] [below grade] [and] [on edges of slabs-on-grade.] Fasten insulation with [adhesive] [or] [mechanical fasteners].

] [3.6.3 Insulation Under Slab

Provide insulation horizontally under [entire] slab on grade [for a distance of [\_\_\_\_\_] feet from the edge of slab]. [Turn insulation up at slab edge, and extend full height of slab.] Install insulation on top of vapor retarder and turn retarder up over the outside edge of insulation to top of slab.

] [3.6.4 Protection of Insulation

Protect insulation from damage during construction and back filling by application of protection board or a coating. Do not leave installed

vertical insulation unprotected overnight. Protect installed insulation from weather, including rain and ultraviolet light, from mechanical abuse, compression, and dislocation. [Install protection over entire exposed exterior insulation board.] [Extend protection at least 1 foot below grade.]

] [3.7 VAPOR RETARDER

Apply vapor retarder continuous across all surfaces. Overlap all joints at least 6 inches and seal with pressure sensitive tape. Seal at sills, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

] [3.8 ACCESS PANELS AND DOORS

Attach insulation to all access panels greater than 1 square foot and all access doors in insulated floors and ceilings. Use insulation with same R-Value as that for the floor or ceiling in which each panel occurs.

] -- End of Section --

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## SECTION 07 21 16

## MINERAL FIBER BLANKET INSULATION

11/11, CHG 4: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C665	(2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D3575	(2020) Flexible Cellular Materials Made From Olefin Polymers
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D5359	(2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31 (2020) Standard for the Installation of Oil-Burning Equipment

NFPA 54 (2021) National Fuel Gas Code

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

NFPA 211 (2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

## TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM (2010) Puncture Test of Container Board

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

## UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket Insulation

Recycled Content for Insulation Materials; S

[ Sill Sealer Insulation  
][ Vapor Retarder  
] Pressure Sensitive Tape  
Accessories

#### SD-07 Certificates

Indoor Air Quality for Insulation Materials; S

Indoor Air Quality for Adhesives; S

#### SD-08 Manufacturer's Instructions

##### Insulation

### 1.3 CERTIFICATIONS

Submit required indoor air quality certifications and validations in one submittal package.

#### 1.3.1 Insulation Products

Provide product certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification from certification body.

#### 1.3.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### 1.4 DELIVERY, STORAGE, AND HANDLING

#### 1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

#### 1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

### 1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665, Type [I, blankets without membrane coverings] [and] [II, blankets with non-reflecting coverings] [and] [III, blankets with reflective coverings]; Class [A, membrane-faced surface with a flame spread of 25 or less] [B, membrane-faced surface with a flame propagation resistance; critical radiant flux of 0.11 Btu/ft<sup>2</sup> or greater], except a flame spread rating of [25] [75] [100] or less [and a smoke developed rating of 150 or less] when tested in accordance with ASTM E84.

2.1.1 Thermal Resistance Value (R-VALUE)

The R-Value must be as indicated on drawings.

2.1.2 Recycled Materials

Provide insulation materials containing the following minimum percentage of recycled material content by weight:

Fiberglass: 20 percent glass cullet complying with ASTM D5359

Provide data identifying percentage of recycled content for insulation materials.

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

[2.1.4 Reduced Volatile Organic Compounds (VOC) for Insulation Materials

Provide certification of indoor air quality for insulation materials.

] [2.2 SILL SEALER INSULATION

Provide polyethylene foam sill sealer [3.5] [5.5] [7.5] [9.5] inches in width with the following characteristics:.

<u>Physical Properties</u>	<u>Test Method</u>	<u>Measurement</u>
Nominal Thickness	ASTM D3575	3/16 inch
Compressive Strength	ASTM D3575	1.2 psi

<u>Physical Properties</u>	<u>Test Method</u>	<u>Measurement</u>
- Vertical Direction	Suffix D	
Tensile Strength	ASTM D3575	32 psi
	Suffix T	

]2.3 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E136 for blocking around chimneys and heat producing devices.

[2.4 VAPOR RETARDER

[ a. 6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 1 perm or less when tested in accordance with ASTM E96/E96M.

] [b. Membrane with the following properties:

- [ Water Vapor Permeance: ASTM E96/E96M: [1] [ ] perm
- ][ Maximum Flame Spread: ASTM E84: [25] [50] [ ]
- ][ Combustion Characteristics: Passing ASTM E136
- ][ Puncture Resistance: TAPPI T803 OM: [15] [25] [50]

]]2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D3833/D3833M.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for adhesives.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.6.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

### 3.2 PREPARATION

#### 3.2.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through soffit vents at eaves. [ Install permanent blocking around attic trap doors. ] [ Install permanent blocking to maintain accessibility to equipment or controls that require maintenance or adjustment. ]

#### 3.2.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.
- b. Masonry chimneys or masonry enclosing a flue: 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.
- c. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.
- d. Gas Fired Appliances: Clearances as required in NFPA 54.
- e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

### 3.3 INSTALLATION

#### 3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe

safe work practices.

#### 3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

#### 3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions.

[Where insulation required is thicker than depth of joist, provide full width blankets to cover across top of joists.] Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

#### 3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

#### [3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

#### ]3.3.1.5 Insulation Blanket with Affixed Vapor Retarder

Locate vapor retarder as indicated. Do not install blankets with affixed vapor retarders unless so specified. Unless the insulation manufacturer's instructions specifically recommend not to staple the flanges of the vapor retarder facing, staple flanges of vapor retarder at 6 inch intervals flush with face or set in the side of truss, joist, or stud. Avoid gaps and bulges in insulation and "fishmouth" in vapor retarders. Overlap both flanges when using face method. Seal joints and edges of vapor retarder with pressure sensitive tape. Stuff pieces of insulation into small cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers. Cover these insulated cracks with vapor retarder material and tape all joints with pressure sensitive tape to provide air and vapor tightness.

#### ]3.3.1.6 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

#### ]3.3.1.7 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

#### [3.3.1.8 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents. [Attach insulation to attic door by adhesive or staples.]

## ][3.3.1.9 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of masonry or concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

## ][3.3.1.10 Special Requirements for Floors

Hold insulation in place with corrosion resistant wire mesh, wire fasteners, or wire lacing.

## ][3.3.1.11 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

## ][3.3.2 Installation of Separate Vapor Retarder

Apply continuous vapor retarder as indicated. Overlap joints at least 6 inches and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

] -- End of Section --



## SECTION 07 22 00

ROOF AND DECK INSULATION  
02/16, CHG 3: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C552	(2022) Standard Specification for Cellular Glass Thermal Insulation
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C726	(2017) Standard Specification for Mineral Wool Roof Insulation Board
ASTM C728	(2017; R 2022) Standard Specification for Perlite Thermal Insulation Board
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1289	(2022) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D312	(2000; R 2006) Standard Specification for Asphalt Used in Roofing
ASTM D2178/D2178M	(2015a) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free

ASTM D4601/D4601M	(2004; R 2020) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D4897/D4897M	(2016) Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
FM GLOBAL (FM)	
FM 4450	(1989) Approval Standard for Class 1 Insulated Steel Deck Roofs
FM 4470	(2016) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IBC	(2018) International Building Code
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 1	(2021) Fire Code
SCIENTIFIC CERTIFICATION SYSTEMS (SCS)	
SCS	SCS Global Services (SCS) Indoor Advantage
UNDERWRITERS LABORATORIES (UL)	
UL 1256	(2002; Reprint Jul 2013) Fire Test of Roof Deck Constructions
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Insulation Board Layout and Attachment; G[, [\_\_\_\_\_]]

Verification of Existing Conditions; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Insulation; G[, [\_\_\_\_\_]]

Cover Board; G[, [\_\_\_\_\_]]

Fasteners; G[, [\_\_\_\_\_]]

Sheathing Paper; G[, [\_\_\_\_\_]]

Moisture Control; G[, [\_\_\_\_\_]]

[ Asphalt Products; G[, [\_\_\_\_\_]]

] Recycled Content For Insulation; S

#### SD-06 Test Reports

Flame Spread Rating; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Installer Qualifications; G[, [\_\_\_\_\_]]

Certificates Of Compliance For Felt Materials; G[, [\_\_\_\_\_]]

Indoor Air Quality For Insulation; S

#### SD-08 Manufacturer's Instructions

Nails and Fasteners; G[, [\_\_\_\_\_]]

Roof Insulation; G[, [\_\_\_\_\_]]

### 1.3 SHOP DRAWINGS

Submit [insulation board layout](#) and attachment indicating methods of attachment and spacing, transitions, tapered components, thicknesses of materials, and closure and termination conditions. Show locations of ridges, valleys, crickets, interface with, and slope to, roof drains. Base shop drawings on verified field measurements and include [verification of existing conditions](#). [ Show wood nailers.] [Show location and spacing of wood nailers required for securing of insulation [and backnailing of roofing felts]].

### 1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for [cover board](#) or coatings, and precautions for flammability and toxicity. Include data to verify compatibility of sealants with insulation.

### 1.5 MANUFACTURER'S INSTRUCTIONS

Include field of roof and perimeter attachment requirements.

Provide a complete description of installation sequencing for each phase of the roofing system. Include weatherproofing procedures.

#### 1.6 QUALITY CONTROL

Provide certification of [installer qualifications](#) from the insulation manufacturer confirming the specific installer has the required qualifications for installing the specific roof insulation system(s) indicated.

Provide [certificates of compliance for felt materials](#).

#### [1.7 FM APPROVAL REQUIREMENTS

Provide fastening patterns in accordance with [FM 1-60] [FM 1-90] [FM 1-120] for insulation on steel decks.

#### ]1.8 FIRE PERFORMANCE REQUIREMENTS

##### 1.8.1 Insulation in Roof Systems

Comply with the requirements of [ICC IBC](#) [or [UL 1256](#)] [or [FM 4450](#)] [or [FM 4470](#)]. Roof insulation to have a [flame spread rating](#) of 75 or less when tested in accordance with [ASTM E84](#). Additional documentation of compliance with flame spread rating is not required when insulation of the type used for this project as part of the specific roof assembly is listed and labeled as FM Class 1 approved. [Only roof assemblies that pass [FM 4450](#) may be used.]

##### 1.8.2 Thermal Barrier Requirements

Separate [polyurethane] [or] [polystyrene] insulation from a [combustible] [steel] deck with a thermal barrier of glass mat gypsum roof board or other approved barrier material in accordance with the requirements of the [ICC IBC](#) [or [FM 4450](#)] [or [FM 4470](#)] [or [UL 1256](#)]. [Only roof assemblies that pass [FM 4450](#) may be used.]

##### 1.8.3 Fire Resistance Ratings for Roofs

Provide in accordance with [ICC IBC](#) Chapter 7 and Table 721.1(3) Min [Fire and Smoke] Protection For Floor and Roof Systems.

#### 1.9 CERTIFICATIONS

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification documentation from certification body.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

##### 1.10.1 Delivery

Deliver materials to the project site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

- a. Name of manufacturer

- b. Brand designation
  - c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification
  - [ d. [Asphalt](#) flashpoint (FP), equiviscous temperature (EVT), and finished blowing temperature (FBT).
- ] Deliver materials in sufficient quantity to allow continuity of the work.

#### 1.10.2 Storage and Handling

Store and handle materials in accordance with manufacturer's printed instructions. Protect from damage, exposure to open flame or other ignition sources, wetting, condensation, and moisture absorption. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. [Store felt rolls on ends. For the 24 hours immediately before application of felts, store felts in an area maintained at a temperature no lower than [50 degrees F](#) above grade and having ventilation on all sides.] Replace damaged material with new material.

#### 1.11 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below [40 degrees F](#) and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

#### 1.12 PROTECTION

[ Provide protection as specified in [\_\_\_\_\_].

##### ] [1.12.1 Flame Heated Equipment

##### 1.12.1.1 Fire Protection

Locate melt kettles no closer than [25 feet](#) from buildings or combustible materials. Provide and maintain two approved 4-A:40-B:C fire extinguishers within [25 feet](#) of each operating kettle. Fire extinguishers, operations and locations must comply with [NFPA 1](#) Section Tar Kettles. Equip asphalt (tar) kettles with tight fitting lids.

##### 1.12.1.2 Operational Requirements

Equip kettles with automatic thermostatic control capable of maintaining asphalt temperature. Calibrate and maintain controls in working order for the duration of the work. Equip kettles with means of agitation and ensure they are operating as necessary to produce a controlled uniform temperature throughout kettle contents to prevent spot heating. Do not heat contents above flash point. Do not place flame heated equipment on the roof.

##### ] [1.12.2 Special Protection

Provide special protection as approved by the insulation manufacturer.

##### ] [1.12.3 Drippage of Bitumen

Seal joints in and at edges of deck as necessary to prevent drippage of asphalt into the building or onto adjacent surfaces.

#### ]1.12.4 Completed Work

Cover completed work with cover board for the duration of construction. Avoid traffic on completed work particularly when ambient temperature is above 80 degrees F. Replace crushed or damaged insulation prior to roof surface installation.

### PART 2 PRODUCTS

#### 2.1 INSULATION

##### 2.1.1 Insulation Types

Provide one, or an assembly of a maximum of three, of the following roof insulation materials. Provide roof insulation that is compatible with attachment methods for the specified insulation and roof membrane.

- a. Expanded Perlite Board: Provide in accordance with ASTM C728. Minimum 3/4 inch thick when both top and bottom surfaces must be in contact with asphalt.
- b. Polyisocyanurate Board: Provide in accordance with ASTM C1289 REV A [Type I, foil faced both sides] [or] [Type II, fibrous felt or glass mat membrane both sides], except minimum compressive strength of 20 pounds per square inch (psi).
- c. Composite Boards: Provide in accordance with ASTM C1289 REV A, [Type III, perlite insulation board faced on one side with fibrous felt or glass fiber mat membrane on opposite side.] [Type V, oriented strand board or waferboard on one side and fibrous felt or glass fiber mat membrane or aluminum foil on opposite side (Polyisocyanurate-perlite).]
- d. Cellular Glass Boards: ASTM C552, Type IV.
- [ e. Polystyrene Board: In accordance with ASTM C578 REV A, Type II, IV, or X.
- ] f. Wood Fiberboard: In accordance with ASTM C208[, high density], except 4 by 4 feet maximum board size.

ASTM C208 Type II, Grade 1 or 2, roof insulating board, treated with sizing, wax or bituminous impregnation. Limit bituminous impregnation to 4 percent by weight when used over steel decks. Maximum board size: 4 feet by 4 feet.

##### ]2.1.2 Mineral Fiber Insulation Board

Provide in accordance with ASTM C726.

##### 2.1.3 Recycled Materials

Provide thermal insulation materials containing recycled content. Unless specified otherwise, the minimum required recycled content for listed materials are:

Perlite Composition Board:	75 percent postconsumer paper
Polyisocyanurate/polyurethane:	9 percent recovered material
Wood Fiberboard:	100 percent recovered material
Cellular Glass Insulation:	75 percent recovered content
Structural Fiberboard:	100 percent recovered content
Fiberglass Insulation:	25 percent recovered content
Fiber (felt) or Fiber composite:	75 percent recovered content
Rubber:	90 percent recovered content
Plastic or Plastic/Rubber composite:	90 percent recovered content
Wood/Plastic Composite:	90 percent total recovered content

Provide data identifying percentage of [recycled content for insulation](#).

#### 2.1.4 Indoor Air Quality

Provide certification of [indoor air quality for insulation](#).

#### 2.1.5 Insulation Thickness

As necessary to provide the thermal resistance (R-value) indicated [ for average thickness of tapered system]. Base calculation on the R-value for aged insulation. [ For insulation over steel decks, satisfy both specified R-value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature].

#### [2.1.6 Tapered Roof Insulation

One layer of the tapered roof insulation assembly must be factory tapered to a slope of not less than one in [24] [48] [\[1/4\] \[1/2\] inch per foot](#). Factory fabricate mitered joints from two diagonally cut boards or one board shaped to provide required slopes.

#### ] [2.1.7 Cants and Tapered Edge Strips

Provide preformed cants and tapered edge strips of the same material as the roof insulation. When unavailable, provide pressure-preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the roofing manufacturer for the specific application, unless otherwise indicated. Face of cant strips to incline at 45 degrees with a minimum vertical height of [4 inches](#). Taper edge strips at a rate of [one to 1 1/2 inch per foot](#) down to approximately [1/8 inch](#) thick.

#### ] [2.2 COVER BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or cover board for hot-mopped, torched-down, or adhesive-applied roofing membrane over roof insulation.

## [2.2.1 Glass Mat Gypsum Roof Board

ASTM C1177/C1177M, 0 Flame Spread and 0 Smoke Developed when tested in accordance with ASTM E84, 500 psi, Class A, non-combustible, [1/4] [1/2] [5/8] inch thick, 4 by 8 feet board size.

## ] [2.2.2 High Density Wood Fiber

Provide high density fiber board, Grade 2 in accordance with ASTM C208 with a transverse load of 12 lbf.

## ]] [2.3 BITUMENS

## [2.3.1 Asphalt Primer

Provide in accordance with ASTM D41/D41M.

## ] [2.3.2 Asphalt

Provide in accordance with ASTM D312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and mechanical spreader application must be indicated on each container.

## ] [2.3.3 Asphalt Roof Cement

Provide in accordance with ASTM D4586/D4586M, Type I, for horizontal surfaces and surfaces sloped from 0 to 3 inches per foot. Type II for vertical and surfaces sloped more than 3 inches per foot.

## ]] [2.4 SHEATHING PAPER FOR WOOD DECKS

Rosin-sized building paper or unsaturated felt weighing not less than 5 pounds per 100 square feet.

## ] 2.5 MOISTURE CONTROL

## [2.5.1 Vapor Retarder

## [2.5.1.1 Asphalt Saturated Felt Base Sheet for Single Layer Application

Provide in accordance with ASTM D4601/D4601M, weighing not less than 35 pounds per 100 square feet.

## ] [2.5.1.2 Asphalt-Coated Glass Felt

Provide in accordance with ASTM D2178/D2178M, Type [IV] [VI].

## ]] [2.5.2 Ventilating Felt for [Poured] [Precast] Concrete Decks

Provide in accordance with ASTM D4897/D4897M, Type II, non-perforated, with spot mopping holes where specified.

## ] 2.5.3 Organic Roofing

Provide in accordance with ASTM D226/D226M, Type I.

## 2.6 FASTENERS

Provide flush-driven fasteners through flat round or hexagonal steel or



plastic plates. Provide zinc-coated steel plates, flat round not less than 1 3/8 inch diameter, hexagonal not less than 28 gage. Provide high-density plastic plates, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fully recess fastener head into plastic plate after it is driven. Form plates to prevent dishing. Do not use bell or cup shaped plates. Provide fasteners in accordance with insulation manufacturer's recommendations for holding power when driven, or a minimum of [40 pounds] [120 pounds] each in steel deck, whichever is the higher minimum. Provide fasteners for steel or concrete decks in accordance with FM APP GUIDE (<http://www.approvalguide.com/>) for Class I roof deck construction, and spaced to withstand uplift pressure of [60] [90] [\_\_\_\_\_] pounds per square foot.

#### 2.6.1 Roofing Nails for Wood Decks

Barbed 11 gage, zinc-coated nails with 7/16 to 5/8 inch diameter heads or annular ring shank, square head, one piece composite nails. Provide nails long enough to penetrate wood deck at least 5/8 inch without protruding through underside of decking.

#### 2.6.2 Fasteners for Plywood Decks

Annular ring shank, square head, one piece composite nails long enough to penetrate into plywood decks approximately 1/2 inch without protruding through underside of decking.

#### 2.6.3 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws in accordance with FM 4450 and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of [60] [90] [\_\_\_\_\_] psf in accordance with FM APP GUIDE.

#### 2.6.4 Fasteners for Poured Concrete Decks

Approved hardened fasteners or screws to penetrate deck at least 1 inch but not more than 1 1/2 inches, in accordance with FM 4470, and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand an uplift pressure of [60] [90] [\_\_\_\_\_] psf in accordance with FM APP GUIDE.

### 2.7 WOOD NAILERS

Pressure-preservative treated as specified in Section 06 10 00 ROUGH CARPENTRY.

## PART 3 EXECUTION

### 3.1 EXAMINATION AND PREPARATION

#### 3.1.1 Surface Inspection

Ensure surfaces are clean, smooth, and dry prior to application. [Ensure surfaces receiving vapor retarder are free of projections that might puncture the vapor retarder.] Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The [Contractor must] [Contracting Officer will] inspect and approve the surfaces immediately before starting installation. Prior to installing

[vapor retarder] [ventilating felt] [insulation], perform the following:

- [ a. Examine wood decks to ascertain that deck boards have been properly nailed and that exposed nail heads have been set.
- ] [b. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.
- ] [c. Examine precast concrete decks to ensure that joints between precast units are properly grouted and leveled to provide suitable surfaces for installation of [ventilating felt] [vapor retarder] [and] insulation.
- ] [d. In the presence of the Contracting Officer perform the following surface dryness test on concrete substrates:
  - (1) Foaming: When poured on the deck, one pint of asphalt when heated in the range of 350 to 400 degrees F, does not foam upon contact.
  - (2) Strippability: After asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from surface, do not consider surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been re-tested by method above and found dry.
- ] [e. Prior to installing any roof system on a concrete deck, moisture test the deck in accordance with [ASTM D4263](#). The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

### ] 3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage from hollow or low spots, perform the following:

- a. Provide wood nailers of the same thickness as the insulation at eaves, edges, curbs, walls, and roof openings for securing of cant strips, gravel stops, [gutters,] and flashing flanges. [On decks with slopes of one in 12 (1 inch per foot) or more, install wood nailers perpendicular to slope for securing insulation [and for backnailing of roofing felts]. Space nailers in accordance with approved shop drawings.]
- [ b. Fill or cover cracks or knot holes larger than 1/2 inch in diameter in wood decks as necessary to form an unyielding surface.
- ] [ c. Cover wood decks with a layer of rosin-sized building paper or unsaturated felt. Lap sides and ends not less than 3 inches. Nail sufficiently to prevent tearing or buckling during installation.
- ] [d. Cover steel decks with a layer of insulation board of sufficient width to span the width of a deck rib opening, and in accordance with fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement in accordance with [FM APP GUIDE](#). Locate insulation joints parallel to ribs of deck on solid bearing surfaces only, not over open ribs.

]e. Solidly apply asphalt primer to [poured] [precast] concrete decks at the rate of 1 gallon per 100 square feet of roof surface [, stopping approximately 4 inches from joints between precast concrete units]. Allow primer to dry thoroughly. [Place felt strips, 4 inches or more in width, over joints, 2 inches on each side, between precast concrete units in a heavy coating of cold-applied asphalt roof cement.]

### ]3.2 INSTALLATION OF VAPOR RETARDER

Install vapor retarder in direct contact with [roof deck surface] [ventilating felt] [insulation]. Unless otherwise specified, vapor retarder to consist of [either] two plies of No. 15 asphalt-saturated felt, two plies of asphalt-coated glass felt [, or one layer of asphalt-saturated felt base sheet]. Lay vapor retarder at right angles to direction of slope. Install first ply of felt [or base sheet] as specified herein for the specific deck. Apply second ply of 2-ply vapor retarder system using asphalt at rate of 20 to 35 lbs per 100 square feet, applied within plus or minus 25 degrees F of EVT. Do not heat asphalt above asphalt's FBT or 525 degrees F, whichever is less. Use thermometers to check temperatures during heating and application. Completely seal side and end laps. Asphalt must be visible beyond all edges of each ply as it is being installed. Lay plies free of wrinkles, buckles, creases or fishmouths. Do not walk on mopped surfaces while asphalt is sticky. Press out air bubbles to obtain complete adhesion between surfaces. At walls, eaves, rakes, and other vertical surfaces, extend vapor retarder organic felts or separate plies 9 inches, with not less than 9 inches on the substrate, and the extended portion turned back and mopped in over the top of the insulation. At roof penetrations other than walls, eaves and rakes, and vertical surfaces, extend vapor retarder or separate plies 9 inches to form a lap folded back over the edge of the insulation. Provide asphalt roof cement under the vapor retarder for at least 9 inches from walls, eaves, rakes and other penetrations.

#### ]3.2.1 Vapor Retarder on Poured Concrete Decks

Evenly mop primed substrate with asphalt at a rate of 20 to 35 lbs per 100 square feet before installing vapor retarder. Lay first ply of two-ply system with each sheet lapping 19 inches over the preceding sheet. Lap ends not less than 4 inches. Stagger laps a minimum of 12 inches. [For a vapor retarder consisting of one layer of asphalt base sheet, provide side and end laps not less than 4 inches. Stagger laps a minimum of 12 inches. Cement base sheets together with a solid mopping of asphalt.]

#### ]3.2.2 Vapor Retarder on Precast Concrete Decks

Evenly mop primed substrate with asphalt at a rate of 20 to 35 lbs per 100 square feet before installing vapor retarder. Lay first ply of two-ply system with each sheet lapping 19 inches over preceding sheet. Lap ends not less than 4 inches. Stagger laps a minimum of 12 inches. [For vapor retarder consisting of one layer of asphalt base sheet, provide side and end laps not less than 4 inches and stagger laps a minimum of 12 inches. Cement base sheets together with a solid mopping of asphalt.]

#### ]3.2.3 Vapor Retarder on Wood Decks

Lay first ply of two-ply system dry with each sheet lapping 2 inches over the preceding sheet. Lap ends not less than 4 inches. Stagger laps a minimum of 12 inches. Nail felt at 6 inch intervals along side laps and install two rows of nails approximately 11 inches apart down longitudinal

center of each sheet, with nails staggered at 18 inches on center. [For vapor retarder consisting of one layer of asphalt base sheet, lap each sheet 4 inches over the preceding sheet. Provide end laps not less than 4 inches and stagger laps a minimum of 12 inches.] Cement side and end laps together with solid mopping of asphalt or heavy coat of asphalt roof cement. Nail side laps at 6 inch intervals. Apply asphalt mopping at a rate of 20 to 35 lbs per 100 square feet. Install two rows of nails approximately 11 inches apart down longitudinal center of each sheet, with nails staggered at 18 inches on center.

] [3.2.4 Vapor Retarder on Steel Decks

Even mop the mechanically secured insulation surface with asphalt before installing vapor retarder. For a two-ply vapor retarder, install each sheet lapping 19 inches over the preceding sheet. Lap ends not less than 4 inches. Stagger the laps a minimum of 12 inches. Cement felts together with solid mopping of asphalt. Apply asphalt moppings at rate of 20 to 35 lbs per 100 square feet. [For a vapor retarder consisting of one layer of asphalt base sheet, lap each sheet 4 inches over preceding sheet. Lap ends not less than 4 inches, and stagger laps a minimum of 12 inches. Cement base sheets together with solid mopping of asphalt.]

] 3.2.5 Over Gypsum Insulating Concrete or Lightweight Insulating Concrete

Lay one ply of venting inorganic base sheet, without mopping, at a right angle to the slope with 4 inch side laps and 6 inch end laps. Bond laps with hot asphalt. Stagger end laps. [Nail base sheet 9 inches on center at side laps and in 2 rows 11 inches apart down the center of the sheet with nails 18 inches on centers and staggered] [attach to the concrete deck in accordance with uplift requirements]. Apply 2-ply vapor retarder over the base sheet as specified above.

3.2.6 Over Concrete Decks and First Layer of Insulation on Steel Decks

Apply 2-ply vapor retarder as specified above except delete the venting inorganic base sheet.

3.2.7 Over Structural Concrete on Non-Venting Support

Lay one ply of venting inorganic base sheet with mopping holes at a right angle to the slope with 4 inch side laps and 6 inch end laps then apply the vapor retarder as specified.

[3.3 INSTALLATION OF VENTILATING FELT

Apply ventilating felt in accordance with manufacturer's printed instructions[, spot mopped with asphalt to concrete deck]. Extend over roof cants, up vertical surfaces and terminate under cap flashing. At roof edges terminate under outside edge of perimeter edge nailers or under gravel stop fascia.

] 3.4 INSULATION INSTALLATION

Apply insulation in two layers with staggered joints when total required thickness of insulation exceeds 1/2 inch. Lay insulation so that continuous longitudinal joints are perpendicular to direction of [felts for the built-up] roofing, as specified in Section [\_\_\_\_], and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, provide joints of each succeeding layer that

are parallel and offset in both directions with respect to the layer below. Keep insulation  $1/2$  inch clear of vertical surfaces penetrating and projecting from roof surface. Verify required slopes to each roof drain.

#### [3.4.1 Installation Using Asphalt

Firmly embed each layer in solid asphalt mopping; mop only sufficient area to provide complete embedment of one board at a time. Provide 20 to 35 lbs of asphalt per 100 square feet of roof deck for each layer of insulation. Apply asphalt when temperature is within plus or minus 25 degrees F of EVT. Do not heat asphalt above asphalt's FBT or 525 degrees F, whichever is less, for longer than 4 consecutive hours. Use thermometers to check temperatures during heating and application.

#### ] [3.4.2 Installation Using Asphalt on Steel Decks

Secure first layer of insulation [and thermal barrier] to deck with piercing or self-drilling, self-tapping fasteners. Engage fasteners by driving them through insulation into top flange of steel deck. Use driving method prescribed by fastener manufacturer. Locate insulation joints parallel to ribs of deck on solid bearing surfaces only, not over open ribs. Secure succeeding layers with solid asphalt moppings. Where insulation is applied over steel deck, locate long edge joints so that they bear continuously on the steel deck. Insulation that can be readily lifted after installation is not considered adequately secured. Apply insulation only in quantities that can be entirely waterproofed the same day. Phased construction is not permitted. Apply impermeable faced insulation without damage to the facing.

#### ] [3.4.3 Installation of Protection for Asphalt Work

Before starting asphalt work, protect surrounding areas and surfaces from spillage and migration of asphalt onto other work. Provide non-combustible protective coverings at surfaces adjacent to hoists and kettles. Lap protective coverings at least 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of asphalt work.

#### ] [3.4.4 Installation Using Only Mechanical Fasteners

Secure total thickness of insulation with penetrating type fasteners.

#### ] 3.4.5 Special Precautions for Installation of Foam Insulation

##### [3.4.5.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, install  $1/2$  inch thick wood fiberboard, glass mat gypsum roof board, or  $3/4$  inch thick expanded perlite board insulation over top surface of foam board insulation. Stagger joints of insulation with respect to foam board insulation below.

##### ] [3.4.5.2 Polystyrene Insulation

- a. Over the top surface of non-composite polystyrene board, install  $1/2$  inch thick high density wood fiberboard,  $3/4$  inch thick expanded perlite board, glass mat gypsum roof board, or other overlayment approved by roofing sheet manufacturer. Tightly butt and stagger joints of field applied overlayment board at least 6 inches with

respect to the polystyrene board below. Apply 6 inch wide glass fiber roofing tape centered over joints and edges of overlayment board.

- b. Where composite boards consisting of polystyrene insulation are provided, apply 6 inch wide glass fiber roofing tape centered over joints and edges of composite board. Apply joint strips as recommended by roofing sheet manufacturer.

#### ]3.4.6 Cant Strips

Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips must bear on and be anchored to wood blocking. Fit cant strips flush to vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in [heavy mopping of asphalt or set in a heavy coating of asphalt roof cement] [an approved adhesive].

#### 3.4.7 Tapered Edge Strips

Where indicated, provide edge strips in the right angle formed by the juncture of roof and wood nailing strips that extend above the level of the roof. Install edge strips flush to vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install in [a heavy mopping of asphalt or set in a heavy coating of asphalt roof cement] [an approved adhesive].

### 3.5 PROTECTION

#### 3.5.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with finished roofing specified in [\_\_\_\_\_] on same day. Phased construction is not permitted. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces is not permitted. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight in accordance with [indicated live load limits of roof construction] [a [\_\_\_\_\_] psf live load limit]. Protect exposed edges of insulation with cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs must be two layers of bituminous-saturated felt set in plastic bituminous cement [or single ply] [or EPDM membrane] set in roof cement. Fill all profile voids in cutoffs to prevent trapping moisture below the membrane. Remove cutoffs when work resumes.

#### 3.5.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

### 3.6 INSPECTION

Establish and maintain inspection procedures to assure compliance of the installed roof insulation with contract requirements. Remove, replace, correct in an approved manner, any work found not in compliance. Quality control must include, but is not limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM Data Sheets. (<https://www.fmglobal.com/fmglobalregistration/Downloads.aspx>)
- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.
- d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.
- e. Inspection of mechanical fasteners; type, number, length, and spacing.
- f. Coordination with other materials, cants, sleepers, and nailing strips.
- g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- h. Installation of cutoffs and proper joining of work on subsequent days.
- i. Continuation of complete roofing system installation to cover insulation installed same day.
- j. Verification of required slope to each roof drain.

-- End of Section --

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## SECTION 07 24 00

## EXTERIOR INSULATION AND FINISH SYSTEMS

05/11, CHG 4: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C67/C67M	(2021) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C473	(2019) Standard Test Methods for Physical Testing of Gypsum Panel Products
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C847	(2014a) Standard Specification for Metal Lath
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1186	(2022) Standard Specification for Flat Fiber-Cement Sheets
ASTM C1278/C1278M	(2017) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM C1325	(2021) Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D3273	(2016) Standard Test Method for Resistance to Growth of Mold on the Surface of

	Interior Coatings in an Environmental Chamber
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E695	(2003; R 2015; E 2015) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM E2098/E2098M	(2013) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
ASTM E2486	(2006) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
ASTM E2570/E2570M	(2007; R 2014; E 2014) Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IBC	(2018) International Building Code
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 268	(2012) Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source
NFPA 285	(2012) Standard Fire Test Method for

Evaluation of Fire Propagation  
Characteristics of Exterior  
Non-Load-Bearing Wall Assemblies  
Containing Combustible Components

## 1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) must be a job-fabricated, drainable, exterior wall covering consisting of sheathing, [ air and moisture barrier,] insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components must be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials must be installed by an applicator approved by the system manufacturer. EIFS must be [Class PB] [or] [Class PM] [as indicated] and must be [\_\_\_\_\_] color and [\_\_\_\_\_] finish.

### 1.2.1 System Requirements and Tests

The system must meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

#### 1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with [ASTM E331](#). There must be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at [6.4 psf](#), or 20 percent of positive design wind pressure, whichever is greater.

#### 1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with [ASTM E330/E330M](#) (procedure A) to a minimum pressure of [\_\_\_\_\_] psf. There must be no permanent deformation, delamination, or other deterioration.

#### 1.2.1.3 Full scale or intermediate scale fire test

Conduct [wall fire test](#) using apparatus, specimen, performance criteria, and procedure in accordance with [NFPA 285](#) when required by [ICC IBC 2603.5.5](#). The following requirements must be met:

- a. No vertical spread of flame within core of panel from one story to the next.
- b. No flame spread over the exterior surface.
- c. No vertical flame spread over the interior surface from one story to the next.
- d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

#### 1.2.1.4 Mock-Up Installation of EIFS

Complete wall mock-up installation [\_\_\_\_\_] ft high by [\_\_\_\_\_] ft wide, including typical control joints [and at least one window opening]. Control joints to be filled with sealant of type, manufacturer, and color selected. Construct mock-up installation at [manufacturer's plant] [job site]. Build mock-up to comply with the following requirements, using materials indicated for the completed work:

- a. Locate mock-up installation(s) in the location and size [indicated] [as directed by the Contracting officer].
  - b. Demonstrate the proposed range of color, texture, thickness, insulation, and workmanship.
  - c. Obtain Contracting Officer's written approval of mock-up before starting fabrication of work.
  - d. Maintain mock-up installation(s) during construction as a standard for judging the completed work by protecting them from weather and construction activities.
- [ e. When directed, demolish and remove mock-up from the site.

#### ]1.2.2 Component Requirements and Tests

The components of the system must meet the performance requirements as verified by the tests listed below.

##### 1.2.2.1 Surface Burning Characteristics

Conduct [ASTM E84](#) test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index must be 25 or less and the smoke developed index must be 450 or less.

##### 1.2.2.2 Radiant Heat

The system must be tested in accordance with [NFPA 268](#) on both the minimum and maximum thickness of insulation intended for use with no ignition during the 20-minute period.

##### 1.2.2.3 Impact Resistance

- a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with [ASTM E2486](#). The test specimen must exhibit no broken reinforcing fabric per [ASTM E2486](#) at an impact of [\_\_\_\_\_] in/lb.
- b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with [ASTM E695](#). The test specimen must exhibit no cracking or denting after twelve impacts by 30 lbs lead shot mass from 6 in to 6 ft drop heights in 6 in intervals.

#### 1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen must consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen must be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to

testing.

#### 1.2.3.1 Abrasion Resistance

Test in accordance with [ASTM D968](#), Method A. Test a minimum of two specimens. After testing, the specimens must show only very slight smoothing, with no loss of film integrity after [132 gallons](#) of sand.

#### 1.2.3.2 Accelerated Weathering

Test in accordance with [ASTM G153](#), Cycle 1. After 2000 hours specimens must exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

#### 1.2.3.3 Mildew Resistance

Test in accordance with [ASTM D3273](#). The specimen shall consist of the finish coat material, applied to clean [3 inch by 4 inch](#) glass slides and must be allowed to cure for 28 days. After 28 days of exposure, the specimen must not show any growth.

#### 1.2.3.4 Salt Spray Resistance

Test in accordance with [ASTM B117](#). The specimen must be a minimum of [4 inch by 6 inch](#) and must be tested for a minimum of 300 hours. After exposure, the specimen must exhibit no observable deterioration, such as chalking, fading, or rust staining.

#### 1.2.3.5 Water Resistance

Test in accordance with [ASTM D2247](#). The specimen must be a minimum of [4 inch by 6 inch](#). After 14 days, the specimen must exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

#### 1.2.3.6 Absorption-Freeze/Thaw

Class PB systems must be tested in accordance with [ASTM E2570/E2570M](#) for 60 cycles of freezing and thawing. After testing, the specimen must exhibit no cracking, checking, or splitting, and negligible weight gain. Class PM systems must be tested in accordance with [ASTM C67/C67M](#) for 50 cycles of freezing and thawing. After testing, the specimens must exhibit no cracking or checking and have negligible weight gain.

#### 1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component [12 by 24 inches](#), on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen must consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

#### 1.2.4 Moisture Analysis

Perform a job specific [vapor transmission](#) analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If

a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Shop Drawings; G[, [\_\_\_\_\_]]

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; [details at [windows] [and] [or] [doors];] and details at [base], [roof], [parapet], [corners], [projecting features], [roof/wall intersections], [abutments of lower walls with higher walls], [\_\_\_\_\_].

#### SD-03 Product Data

[ Sheathing Board  
 ] Thermal Insulation  
 [ Adhesive  
 ] [ Mechanical Fasteners  
 ] Accessories  
 Base Coat  
 Portland Cement  
 Reinforcing Fabric  
 Finish Coat  
 Joint Sealant  
 Sealant Primer  
 Bond Breaker  
 Backer Rod  
 Insulation Board  
 [ Recycled Content for Insulation Materials; S  
 ] Warranty

Include joint and other details, such as end conditions, corners, windows, and parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include Safety Data Sheets (SDS) for all components of the EIFS. The SDS shall be available at the job site.

SD-04 Samples

Sample Boards; G[, [\_\_\_\_\_]]

Color and Texture

[ Mock-up Installation of EIFS; G[, [\_\_\_\_\_]]

] [ SD-05 Design Data

Wind Load Calculations

Moisture Analysis Calculations

] SD-06 Test Reports

Abrasion Resistance

Accelerated Weathering

Impact Resistance

Mildew Resistance

Salt Spray Resistance

Water Vapor Transmission

Absorption-Freeze-Thaw

Wall Fire Test

[ Water Penetration

] [ Water Resistance

] [ Full Scale or Intermediate Scale Fire Test

] Surface Burning Characteristics

Radiant Heat

Substrate

[ Wind Load

] SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

#### Qualifications of Third Party Inspector

##### Inspection Check List; G[, [\_\_\_\_]]

Submit filled-out inspection check list as required in paragraph "Quality Control," certifying that the installation of critical items meets the requirements of this specification.

#### SD-08 Manufacturer's Instructions

##### Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

#### SD-10 Operation and Maintenance Data

##### EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Qualifications of EIFS Manufacturer

The EIFS must be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

#### 1.4.2 Qualification of EIFS Installer

The EIFS Installer must be trained by the EIFS manufacturer to perform the installation of the System and must have successfully installed at least five projects at or near the size and complexity of this project. The contractor must employ qualified workers trained and experienced in installing the manufacturer's EIFS.

#### 1.4.3 Qualification of Sealant Applicator

The sealant applicator must be experienced and competent in the installation of high performance industrial and commercial sealants and must have successfully installed at least five projects at or near the size and complexity of this project.

#### 1.4.4 Qualifications of Third Party Inspector

Submit evidence that third party inspector has current certification from the Exterior Design Institute or equal inspector certification as inspector for the installation of EIFS.



#### 1.4.5 Insulation Board

Insulation Board must be approved and labeled under third party quality program as required by applicable building code.

#### 1.4.6 Pre-Installation Conference

After approval of submittals and before commencing any work on the EIFS, including installation of any [sheathing board,] insulation, and associated work, the Contracting Officer will hold a pre-installation conference to review:

- a. Drawings, specifications, and samples;
- b. Procedure for on site inspection and acceptance of EIFS substrate and pertinent details (for example, mock-up installation);
- c. Contractor's plan for coordination of work of the various trades involved in providing EIF system and other components;
- d. Inspection procedures; and
- e. Safety requirements.

Pre-installation conference must be attended by the Contractor, [EIFS Q.C. Specialist (EIFS Inspector),] and all personnel directly responsible for installation of the EIF system, including sealant applicator, and personnel responsible for related work, such as flashing and sheet metal, windows and doors, and a representative of the EIFS manufacturer. Before beginning EIFS work, the contractor must confirm in writing the resolution of conflicts among those attending the pre-installation conference.

#### 1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

#### 1.6 ENVIRONMENTAL CONDITIONS

- a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.
- b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system must be protected from inclement weather and maintain this temperature for a minimum of 24 hours after installation.
- c. Do not leave insulation board exposed to sunlight after installation.

#### 1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty must run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

## PART 2 PRODUCTS

### 2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

### 2.2 SHEATHING BOARD

#### 2.2.1 Fiber Reinforced Cement Sheathing Board

- a. Meet ASTM C1186, Type A, Grade [I] [\_\_\_\_], or.
- b. Meet ASTM C1325, Type A, Flexural Strength [\_\_\_\_]
- c. Non-combustible per ASTM E136.
- d. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.
- e. Thickness no less than 1/2 inch.
- f. Water Absorption not to exceed 17 percent.

#### [2.2.2 Glass Mat Gypsum Sheathing Board

- a. Conform to ASTM C1177/C1177M; or.
- b. ASTM C1278/C1278M, Water Resistant Exterior Type only
- c. Flexural Strength [\_\_\_\_]
- d. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

### ]2.3 ADHESIVE

[ Manufacturer's standard product, including primer as required, must be compatible with substrate and insulation board to which the system is applied.

### ]2.4 LATHING AND FURRING

Conform to ASTM C847, 2.5 lb/sqyd, self-furring, galvanized.

### 2.5 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

### 2.6 THERMAL INSULATION

#### 2.6.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

#### 2.6.2 Insulation Board

Insulation board must be standard product of manufacturer and must be compatible with other systems components. Boards must be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than 3/4 inch thick. The maximum thickness of all layers must not exceed 4 inches. Insulation Board must be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

- a. Thermal resistance: As indicated on drawings.
- b. Insulating material: [ASTM C578] Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.
- c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.
- [ d. Recycled Content: Provide insulation material that has minimum of 10 percent recycled material. Provide data identifying percentage of recycled content for insulation materials.

#### ]2.7 BASE COAT

Manufacturer's standard product and compatible with other systems components.

#### 2.8 PORTLAND CEMENT

Conform to ASTM C150/C150M, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

#### 2.9 REINFORCING FABRIC

Reinforcing fabric mesh must be alkali-resistant, balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with ASTM E2098/E2098M and as recommended by EIFS manufacturer.

#### 2.10 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

#### 2.11 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

#### 2.12 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, and expansion joints. All metal items and fasteners to be corrosion resistant.

### 2.13 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

### 2.14 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

### 2.15 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface must be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate must be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge. Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

### 3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation instructions [but provide a flatness of not more than [1/4] [\_\_\_\_\_] inch in 10 feet]. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor must not proceed with the installation until all noted deficiencies of the substrate are corrected.

### 3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS must be installed only by an applicator trained by the EIFS manufacturer.

Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations. Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

#### [3.3.1 Sheathing Board

Edges and ends of boards must be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board [to metal studs with self-tapping drywall screws] [to concrete or masonry with corrosion resistant metal fasteners]. Place fasteners sufficiently close to support imposed loads, but not more than:

- [ a. Maximum of 8 inches apart on each supporting stud
- ] [b. Maximum of 12 inches apart horizontally and vertically into [concrete] [masonry].
- ] Space fasteners more closely when required for negative wind load resistance.

#### ]3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 8 inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation must be butted tightly. Surfaces of adjacent insulation boards must be flush at joints. Gaps greater than 1/16 inch between the insulation boards must be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than 1/16 inch must be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board must be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

#### [3.3.2.1 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and vertically.

#### ] [3.3.2.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's instructions.

#### ]3.3.3 Base Coat and Reinforcing Fabric Mesh,

##### [3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh must not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer's instructions.

#### ] [3.3.3.2 Class PM Systems

Mechanically fasten reinforcing fabric mesh to the insulated wall using the type and spacing of fasteners specified in the manufacturer's instructions. Provide diagonal reinforcement at opening corners. Mix base coat in accordance with manufacturer's instructions. Apply base coat in accordance with manufacturer's instruction to provide a complete, tight coating of uniform thickness as specified by the manufacturer. Cover all fiberglass reinforcing fabric, including at back wrapped areas at panel joints and at fasteners.

#### ] 3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., must be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved [sample] [mock-up installation]. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat must be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

### 3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

#### 3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width must not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper width to depth ratio.

#### 3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or cannot be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor must establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance must be removed and replaced or corrected in an approved manner. The inspection procedures, from acceptance of deliveries through installation of sealants and final acceptance must be performed by qualified inspector trained by the manufacturer. No work on the EIFS is allowed unless the inspector is present at the job site.

[3.5.1 Third Party Inspection

Provide full time third party inspection during the entire process of installing the EIFS, from examination through cleanup. The third party inspector must be certified by the Exterior Design Institute (EDI), AWCI, or by an equivalent independent party and must be trained in the proper installation of EIFS.

]3.5.2 Inspection Check List

During the installation and at the completion of installation, perform inspections covering at the minimum all applicable items enumerated on the attached check list. The inspector must initial and date all applicable items, sign the check list, and submit it to the Contracting Officer at the completion of the EIFS erection.

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
a.	Materials are handled and stored correctly.	_____
b.	Environmental conditions are within specified limits, including temperature not below 4 degrees C (40 degrees F), and the work is protected from the elements as required.	_____
c.	Preparation and installation is performed by qualified personnel using the correct tools.	_____
d.	Adjacent areas to which EIFS is not to be applied (such as on window and door frames) are protected with masking tape, plastic films, drop cloths, etc. to prevent accidental application of EIFS materials.	_____

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
e.	Control, expansion and aesthetic joints are installed as indicated or recommended. Accessories are properly installed.	_____
f.	Substrate is in-plane, properly attached, clean, dry, and free of contaminants. Concrete substrate is free of efflorescence.	_____
g.	Materials are mixed thoroughly and in proper proportions.	_____
h.	Adhesive is applied in sufficient quantity with proper-size notched trowel.	_____
i.	Mechanical attachments have proper spacing, layout and fastener depth.	_____
j.	Insulation boards are tightly abutted, in running bond pattern, with joints staggered with the sheathing, board corners interlocked, L-shaped boards around openings, edges free of adhesive, and provision for joints. Gaps are filled and surfaces rasped.	_____
k.	Insulation adhesive must be allowed to dry (a minimum of 24-hours) prior to the application of the base coat.	_____
l.	Reinforcing fabric mesh is properly back-wrapped at terminations.	_____
m.	Reinforcing fabric mesh is fully embedded and properly placed. Corners are reinforced. Openings are diagonally reinforced. Mesh overlaps minimum 65 mm (2-1/2 inches).	_____
n.	Base coat thickness is within specified limits.	_____
o.	The base coat/reinforcing fabric mesh must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	_____
p.	Finish coat is applied with sufficient number of personnel and stopped at suitable points. Floats and methods of texturing are uniform.	_____
q.	All flashings are properly installed.	_____
r.	All joints are properly sealed in their entire length at time and under environmental conditions as specified by the manufacturer.	_____
s.	All scaffolding, equipment, materials, debris and temporary protection are removed from site upon completion.	_____



Name of Inspector:\_\_\_\_\_ Signed:\_\_\_\_\_ Date:\_\_\_\_\_

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

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## SECTION 07 31 13

ASPHALT SHINGLES  
08/16, CHG 2: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D1970/D1970M	(2019) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D3018/D3018M	(2011; R 2017) Standard Specification for Class A Asphalt Shingles Surfaced With Mineral Granules
ASTM D3161/D3161M	(2020) Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method)
ASTM D3462/D3462M	(2019) Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free
ASTM D4869/D4869M	(2016a) Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing
ASTM D6380/D6380M	(2003; E 2013; R 2013) Standard Specification for Asphalt Roll Roofing (Organic Felt)
ASTM D7158/D7158M	(2016) Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)

## NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0437	(2017) The NRCA Roofing Manual:
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Steep-slope Roof Systems

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

UNDERWRITERS LABORATORIES (UL)

UL 790 (2022) UL Standard for Safety Test Methods for Fire Tests of Roof Coverings

UL 2218 (2010; Reprint Aug 2020) UL Standard for Safety Impact Resistance of Prepared Roof Covering Materials

1.2 DEFINITIONS

1.2.1 Top Lap

That portion of shingle overlapping shingle in course below.

1.2.2 Head Lap

The triple coverage portion of top lap which is the shortest distance from the butt edge of an overlapping shingle to the upper edge of a shingle in the second course below.

1.2.3 Exposure

That portion of a shingle exposed to the weather after installation.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Shingles

Energy Star Label for Asphalt Shingle; S

[ Heat Island Reduction; S

][ SD-04 Samples

Shingles; G[, [\_\_\_\_\_]]

Full shingle sample and manufacturer's standard size samples of materials and products requiring color or finish selection.

[ Color Charts; G[, [\_\_\_\_\_]]

]] SD-08 Manufacturer's Instructions

## Application

### SD-11 Closeout Submittals

#### Manufacturer's Warranty

#### Contractor's Warranty

### 1.4 DELIVERY AND STORAGE

Deliver materials in the manufacturer's unopened bundles and containers bearing the manufacturer's brand name. Keep materials dry, completely covered, and protected from the weather. Store according to manufacturer's written instructions. Store roll goods on end in an upright position or in accordance with manufacturer's recommendations. Immediately before laying, store roofing felt for 24 hours in an area maintained at a temperature not lower than 50 degrees F.

### 1.5 WARRANTIES

Warranties must begin on the date of Government acceptance of the work.

#### 1.5.1 Manufacturer's Warranty

Furnish the asphalt shingle manufacturer's standard [25 year] [30 year] [other] warranty for the asphalt shingles. The warranty must run directly to the Government.

#### 1.5.2 Contractor's Warranty

Provide warranty for 5 years that the asphalt shingle roofing system, as installed, is free from defects in workmanship. When repairs due to defective workmanship are required during the Contractor's warranty period, the Contractor must make such repairs within 72 hours of notification. When repairs are not performed within the specified time, emergency repairs performed by others will not void the warranty.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Shingles

Mineral granule-surfaced asphalt shingles, self-sealing, square tab, strip [, fungus-resistant] [impact resistant shingles conforming to [UL 2218](#), Class 4.] [[ASTM D3018/D3018M](#), Type I, and [ASTM D3462/D3462M](#)] [, weighing not less than 210 pounds per 100 square feet] [, architectural shingles weighing not less than 290 pounds per 100 square feet]. Shingles must meet the fire resistance requirements of [UL 790](#) for Class A and the wind resistance requirements of [[ASTM D3161/D3161M](#), Class F] [[ASTM D7158/D7158M](#), Class H]. Color must be [\_\_\_\_\_] [as selected from the manufacturer's standard [color charts](#)]. Shingle color must be [in accordance with COLOR SCHEDULE] [\_\_\_\_\_] . Provide asphalt shingle that is [Energy Star](#) labeled. Provide data identifying [Energy Star label for asphalt shingle](#) product. [ Provide solar reflectance product with an initial solar reflectance greater than or equal to 0.25 and a solar reflectance greater than or equal to 0.15 three years after installation under normal conditions.] [ Provide emittance and reflectance percentages, solar reflectance index values,

[and] slopes [\_\_\_\_], to meet sustainable third party certification requirements for [Heat Island Reduction](#).]

#### 2.1.2 Mineral-Surfaced Asphalt Roll Roofing

[ASTM D6380/D6380M](#).

#### 2.1.3 Smooth-Surfaced Asphalt Roll Roofing

[ASTM D6380/D6380M](#), Type II.

#### 2.1.4 Underlayment

Asphalt-saturated felt conforming to [ASTM D4869/D4869M](#) or [ASTM D226/D226M](#), [Type I, number 15,] [Type II, number 30,] without perforations or other material specified by the shingle manufacturer for use as underlayment.

##### 2.1.4.1 Leak Barrier Underlayment

Self-adhering leak barrier or ice dam underlayment must comply with [ASTM D1970/D1970M](#) for sealability around nails.

#### 2.1.5 Self-Adhering Membrane

Self-adhering rubberized asphaltic membrane, a minimum of 40 mils thick, and recommended by the shingle manufacturer for use as eaves flashing.

#### 2.1.6 Nails for Applying Shingles and Asphalt-Saturated Felt

Aluminum or hot-dipped galvanized steel or equivalent corrosion resistant with sharp points and flat heads  $3/8$  to  $7/16$  inch in diameter. Shank diameter of nails must be a minimum of 0.105 inch and a maximum of 0.135 inch with garb or otherwise deformed for added pull-out resistance. Nails must be long enough to penetrate completely through or extend a minimum of  $3/4$  inch into roof deck, whichever is less, when driven through materials to be fastened.

#### 2.1.7 Asphalt Roof Cement

[ASTM D4586/D4586M](#), Type II.

#### 2.1.8 Asphalt Primer

[ASTM D41/D41M](#).

#### 2.1.9 Ventilators

##### 2.1.9.1 Nailable Plastic Shingle Over Type Ridge Vents

Ridge vents must be constructed of UV stabilized nailable rigid polypropylene material, approximately 1 foot wide and 1 inch thick, and must be in 4 foot long interlocking sections with self-aligning ends or corrugated polyethylene rigid roll or rigid strip ridge vent with aluminum wind deflectors on each side. Vents must be designed to prevent infiltration of insects, rain, and snow.

##### 2.1.9.2 Nailable Mesh Shingle Over Type Ridge Vents

Ridge vents must be constructed of UV stabilized nailable polyester mesh

material, approximately 1 foot wide. Vents must be designed to prevent infiltration of insects, rain, and snow.

### PART 3 EXECUTION

#### 3.1 VERIFICATION OF CONDITIONS

Do not install building construction materials that show visual evidence of biological growth.

Ensure that roof deck is smooth, clean, dry, and without loose knots. Roof surfaces must be firm and free from loose boards, large cracks, and projecting ends that might damage the roofing. Vents and other projections through roofs must be properly flashed and secured in position, and projecting nails must be driven flush with the deck.

#### 3.2 SURFACE PREPARATION

Cover knotholes and cracks with sheet metal nailed securely to sheathing. Flash and secure vents and other roof projections, and drive projecting nails firmly home.

#### 3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by shingle manufacturer's written instructions [or by [NRCA 0437](#)].

##### 3.3.1 Underlayment

[ Provide for roof slopes 4 inches per foot and greater. Apply one layer of shingle underlayment to roof deck. Lay underlayment parallel to roof eaves, starting at eaves. Provide minimum 2 inch head laps, 4 inch end laps, and 6 inch laps from both sides over hips and ridges. Nail sufficiently to hold until shingles are applied. Turn up vertical surfaces a minimum of 4 inches.

]

[ Provide for roof slopes [between 2 inches per foot and 4 inches per foot] [ 4 inches per foot and greater]. Apply two layers to roof deck. Provide a 19 inch wide strip as starter sheet to maintain specified number of layers throughout roof. Lay parallel to eaves, starting at eaves. Provide minimum 19 inch head laps, 6 inch laps from both sides over hips and ridges, and 12 inch end laps in the field of the roof. Nail sufficiently to hold until shingles are applied. Turn up vertical surfaces a minimum of 4 inches.

[When a self-adhering membrane is used for eave flashing, start underlayment from upper edge of eave flashing.]

##### ]3.3.2 Drip Edges

Provide metal drip edges as specified in Section [07 60 00 FLASHING AND SHEET METAL](#) applied directly on the wood deck at eaves and over the underlayment at rakes. Extend back from edge of deck a minimum of 3 inches, and secure with nails spaced a maximum of [4] [10] inches o.c. along inner edge.

##### 3.3.3 Starter Strip

Apply starter strip at eaves, using 9 inch wide strip of mineral-surfaced roll roofing of a color to match shingles. Optionally, use a row of shingles with tabs removed and trimmed to ensure that joints are not

exposed at shingle cutouts. Apply starter strip along eaves, [overlying and finishing even with lower edge of eave flashing strip] [overhanging the metal drip edge at eaves and rake edges **1/4 inch to 3/8 inch**]; fasten in a line parallel to and **3 to 4 inches** above eave edge. Place nails so top of nail is not exposed in cutouts of first course of shingles. [When roll roofing is provided, seal tabs of first course of shingles with asphalt roof cement.] [Fasten with 6 nails per strip of shingles or space nails at **6 inches** o.c. for roll roofing. Seal tabs of first course of shingles with asphalt roof cement as specified below.]

#### 3.3.4 Shingle Courses

Start first course with full shingle, and apply succeeding courses with joints staggered at thirds or halves. Butt-end joints of shingles must not align vertically more often than every fourth course. Apply shingle courses as follows:

- a. Fastening: Do not drive fasteners into or above the factory-applied adhesive unless adhesive is located **5/8 inch** or closer to top of cutouts. Place fasteners so they are concealed by shingle top lap and penetrate the head lap.
- b. Shingles applied with nails: Nominal **5 inch** exposure. Apply each shingle with minimum of four nails. Place one nail **1 inch** from each end, and evenly space nails on a horizontal line a minimum of **5/8 inch** above top of cutouts. [Cement each tab with one spot of asphalt roof cement placed **1 to 2 inches** from bottom edge of shingle.]
- [ c. Nailing: Apply shingles with nominal **5 inch** exposure. Apply each shingle with minimum of six nails. Place one nail **1 inch** from each end and one nail on each side of each cutout, on a horizontal line **5/8 inch** above cutouts.
- ] [d. Sealing: Seal each tab with continuous, **9 inch** long, **1/4 inch** diameter bead of asphalt roof cement, applied to the surface of course below. Place bead on horizontal line **5/8 inch** above cutouts so bead will be **1 inch** from bottom edge of tab to be sealed and so bead will not show through cutouts. After nailing each shingle, press tabs down to ensure spreading and bonding of asphalt roof cement.

#### ]3.3.5 Hips and Ridges

Form with **9 by 12 inch** individual shingles or with **12 by 12 inch** shingles cut from **12 by 36 inch** strip shingles. Bend shingles lengthwise down center with equal exposure on each side of hip or ridge. Lap shingles to provide a maximum **5 inch** exposure, and nail each side in unexposed area **5-1/2 inches** from butt and **1 inch** in from edge.

#### 3.3.6 Valleys

[ Provide either closed cut, woven, open roll roofing, or open sheet metal valleys.

##### ]3.3.6.1 Closed Cut Valleys

Provide **36 inch** wide valley lining of single layer of smooth-surfaced or mineral-surfaced roll roofing, with mineral-surface facing down, for full length of valley as follows:



- a. Center lining in valley over underlayment. Provide minimum 12 inch end laps in the lining and seal laps with asphalt roof cement. Fasten lining to hold it in place until shingles are applied.
- b. Apply first regular course of shingles along eaves of one of the intersecting roof planes and across valley. Extend course at least 12 inches onto adjoining roof.
- c. Apply succeeding courses in same manner as first course, extending across valley and onto adjoining roof.
- d. Press shingles tightly into valley and nail in normal manner, except apply nails not closer than 6 inches to valley centerline, and apply additional nail in top corner of each shingle crossing valley.
- e. Apply shingles on the adjoining roof plane, starting along eaves and across valley onto previously applied shingles. Trim overlapping courses back to a line parallel to and a minimum of 2 inches back from valley centerline.
- f. Trim 1 inch on a 45 degree angle from upper corner of each end shingle. Embed end shingles in a 3 inch wide band of asphalt roof cement.

#### 3.3.6.2 Woven Valleys

Provide valley lining as specified for closed cut valley. Lay valley shingles over lining by either of the following methods:

- a. Method I: Apply regular shingles on both roofs simultaneously. Weave each course in turn over the valley. Lay the first regular course of shingles along eaves of roof up to and over valley. Extend course along adjoining roof deck at least 12 inches. Carry first regular course of shingles of adjoining roof over valley on top of previously applied shingles. Lay succeeding courses alternately, weaving valley shingles over each other for full length of valley.
- b. Method II: Apply regular shingles on each roof surface separately to a line about 3 feet from center of valley, and weave valley shingles in place later, as specified for Method I.

In following either method, press shingles tightly into valley, and fasten in normal manner; except apply nails not closer than 6 inches to valley centerline, and apply additional nail in top corner of terminal shingle on both sides of valley.

#### 3.3.6.3 Open Roll Roofing Valleys

Provide 18 inch wide strip of mineral-surfaced asphalt roll roofing, of a color to blend with asphalt shingles, and with granular surface facing down, for the full length of valley as follows:

- a. Center roll roofing strip in valley over underlayment. Lay centered in valley over felt underlayment and with granular face down. Nail strip only enough to hold in place. Apply nails in rows 1 inch from each edge. As fastening along second side proceeds, press strip firmly into valley.
- b. Center second strip 36 inches wide in valley and lay it over first

strip with granular face exposed and nail as specified for 18 inch strip.

- c. Before applying roofing shingles, snap two chalk lines for full length of valley. Locate each line 3 inches from centerline of valley at top, and increase width between lines by 1 inch for each 8 feet of valley length, continuing to eaves.
- d. Apply a 2 inch band of asphalt roof cement along each edge of 36 inch strip from edge to chalk line. Cut regular shingle courses true along valley chalk lines, and nail in normal manner.

#### 3.3.6.4 Open Sheet Metal Valleys

Sheet metal flashing for valleys is specified in Section 07 60 00 FLASHING AND SHEET METAL. Before installing and fastening flashing in place with metal cleats:

- a. Install single layer of 36 inch wide, asphalt-saturated felt, centered on valley and extending entire length of valley over felt underlayment.
- b. Cut regular shingle courses on each roof on true line 2 inches from valley centerline at top of valley, and increase width between lines by 1 inch for each 8 feet of valley length, continuing to eaves.
- c. Apply 2 inch band of asphalt roof cement over flashing, along and under side of shingles adjoining valley.
- d. Press shingles tightly into cement, and nail in normal manner, except apply nails not closer than 5 inches to valley centerline. Do not drive nails through valley flashing.
- e. Provide a 4 inch band of asphalt roof cement for fastening shingle tabs down along open metal gutters.

#### 3.3.7 Flashing

##### 3.3.7.1 Eave Flashing

[ Provide for roof slopes 4 inches per foot and greater. Provide eave flashing strips consisting of smooth-surfaced roll roofing. Flashing strips must overhang metal drip edge 1/4 inch to 3/8 inch and extend up the slope far enough to cover a point 12 inches inside interior face of exterior wall. Where overhangs require flashings wider than 36 inches, locate laps outside exterior wall face. Laps must be at least 2 inches wide and cemented with asphalt roof cement over entire length of lap. Lap end 12 inches and cement.

]

[ Provide for roof slopes [between 2 inches per foot and 4 inches per foot] [ 4 inches per foot and greater]. Provide either of the following types of eave flashing:

- a. From the eaves to a point 24 inches inside interior wall line, apply solid coating of asphalt roof cement between overlapping layers of underlayment. Spread cement to a uniform thickness at rate of 2 gallons per 100 square feet of cemented roof area.
- b. From the eaves to a point 24 inches inside interior wall line, apply one layer of self-adhering membrane. Follow membrane manufacturer's

printed installation instructions.

]3.3.7.2 Stepped Flashing

For sloping roofs which abut vertical surfaces, provide stepped metal flashing as specified in Section 07 60 00 FLASHING AND SHEET METAL.

3.3.7.3 Vent and Stack Flashing

Apply shingles up to point where vent or stack pipe projects through roof, and cut nearest shingle to fit around pipe. Before applying shingles beyond pipe, prepare flange of metal pipe vent flashing as specified in Section 07 60 00 FLASHING AND SHEET METAL, by applying a 1/8 inch thick coating of asphalt roof cement on bottom side of flashing flange. Slip flashing collar and flange over pipe, and set coated flange in 1/16 inch coating of asphalt roof cement. After applying flashing flange, continue shingling up roof. Lap lower part of flange over shingles. Overlap flange with side and upper shingles. Fit shingles around pipe, and embed in 1/16 inch thick coating of asphalt roof cement where shingles overlay flange.

[3.3.7.4 Chimney Flashing

Provide treated wood crickets as specified in Section 06 10 00 ROUGH CARPENTRY. Provide metal base and counterflashing as specified in Section 07 60 00 FLASHING AND SHEET METAL. Uniformly coat masonry surfaces which are to receive flashing with asphalt primer applied at rate of 1 gallon per 100 square feet. Apply shingles over underlayment up to front face of chimney. Apply metal front base flashing with lower section extending at least 4 inches over shingles. Set base flashing in a 1/16 inch coating of asphalt roof cement on shingles and chimney face. Apply metal step flashing at sides in a coating of asphalt roof cement. Embed end shingles in each course that overlaps step flashing with asphalt roof cement. Apply metal rear base flashing over cricket and back of chimney in coating of asphalt roof cement. Apply end shingles in each course up to cricket, and cement in place. Lap base flashing minimum of 3 inches with metal counterflashing.

] -- End of Section --

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## SECTION 07 41 13

METAL ROOF PANELS  
05/11, CHG 4: 02/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA ADM (2020) Aluminum Design Manual

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341 (2016) Seismic Provisions for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members

AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A424/A424M (2009a; R 2016) Standard Specification for

	Steel Sheet for Porcelain Enameling
ASTM A463/A463M	(2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755/A755M	(2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A792/A792M	(2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C286	(2022) Standard Terminology Relating to Porcelain Enamel and Ceramic-Metal Systems
ASTM C552	(2022) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C792	(2015; R 2020) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D522/D522M	(2017) Mandrel Bend Test of Attached

## Organic Coatings

ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D610	(2008; R 2019) Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D822	(2013; R 2018) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1654	(2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D1970/D1970M	(2019) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3359	(2017) Standard Test Methods for Rating Adhesion by Tape Test
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test

ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D4587	(2011; R 2019; E 2019) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D4637/D4637M	(2015) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D4869/D4869M	(2016a) Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing
ASTM D5894	(2016) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E2140	(2001; R 2017) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM G152	(2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
FM GLOBAL (FM)	
FM 4471	(2010) Class I Panel Roofs
METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)	
MBMA RSDM	(2012) Metal Roofing Systems Design Manual
NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)	
NRCA 0420	(2010) Architectural Metal Flashing, Condensation Control and Reroofing
NRCA RoofMan	(2020) The NRCA Roofing Manual



## PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001 (1996) Specification for Architectural Porcelain Enamel (ALS-100)

PEI CG-3 (2005) Color Guide for Architectural Porcelain Enamel

## SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793 (2012) Architectural Sheet Metal Manual, 7th Edition

## U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

## UNDERWRITERS LABORATORIES (UL)

UL 580 (2006; Reprint Mar 2019) UL Standard for Safety Tests for Uplift Resistance of Roof Assemblies

UL Bld Mat Dir (updated continuously online) Building Materials Directory

## 1.2 DESCRIPTION OF METAL ROOF SYSTEM

## 1.2.1 Performance Requirements

Steel panels and accessory components must conform to the following standards:

ASTM A1008/A1008M

ASTM A123/A123M

ASTM A36/A36M

ASTM A424/A424M, ASTM C286, PEI 1001, PEI CG-3 for Porcelain and Ceramic Enameling

ASTM A463/A463M for aluminum coated steel sheet

ASTM A755/A755M for metallic coated steel sheet for exterior coil prepainted applications.

ASTM A924/A924M for metallic coated steel sheet

ASTM D522/D522M for applied coatings

UL Bld Mat Dir

## 1.2.1.1 Hydrostatic Head Resistance

No water penetration when tested according to ASTM E2140. Submit leakage test report upon completion of installation.

### 1.2.1.2 Wind Uplift Resistance

Provide metal roof panel system that conform to the requirements of [ASTM E1592](#) and [UL 580](#). Uplift force due to wind action governs the design for panels. Submit [wind uplift test report](#) prior to commencing installation.

Provide roof system and attachments that resist the wind loads as determined by [ASCE 7-16](#), in pounds per square foot. Metal roof panels and component materials must also comply with the requirements in [FM 4471](#) as part of a panel roofing system as listed in Factory Mutual Guide (FMG) "Approval Guide" for class 1 or noncombustible construction, as applicable. Identify all materials with FMG markings.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

#### [SD-02 Shop Drawings](#)

[Roofing Panels; G](#)

[Flashing and Accessories; G](#)

[Gutter/Downspout Assembly; G](#)

#### [SD-03 Product Data](#)

Submit manufacturer's catalog data for the following items:

[Roof Panels; G](#)

[Recycled Content for Aluminum Roof Panels; S](#)

[Recycled Content for Steel Roof Panels; S](#)

[Energy Star Label for Metal Roofing Product; S](#)

[Heat Island Reduction; S](#)

[Factory-Applied Color Finish; G](#)

[Accessories; G](#)

[Fasteners; G](#)

[Pressure Sensitive Tape; G](#)

[Underlayments; G](#)

[Gaskets and Sealing/Insulating Compounds; G](#)

[Coil Stock; G](#)

Aluminized Steel Repair Paint; G

Enamel Repair Paint; G

Galvanizing Repair Paint; G

#### SD-04 Samples

Roof Panels; G

Factory-applied Color Finish, Samples, 9 inch lengths, full width;  
G

Accessories; G

Fasteners; G

Gaskets and Sealant/Insulating Compounds; G

#### SD-05 Design Data

Engineering Calculations; G

Wind Uplift Resistance; G

#### SD-06 Test Reports

Leakage Test Report; G

Wind Uplift Test Report; G

Fire Rating Test Report; G

Factory Finish and Color Performance Requirements; G

#### SD-07 Certificates

Roof Panels; G

Coil Stock Compatibility; G

Self-Adhering Modified Bitumen Underlayment; G

Qualification of Manufacturer; G

Qualification of Applicator; G

#### SD-08 Manufacturer's Instructions

Insulation; G

Installation Manual; G

#### SD-09 Manufacturer's Field Reports

Manufacturer's Field Inspection Reports; G

#### SD-11 Closeout Submittals

Warranties; G

Information Card; G

Date Of Installation Wall-Mounted Placard; G

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Qualification of Manufacturer

Submit documentation verifying metal roof panel manufacturer has been in the business of manufacturing metal roof panels for a period of not less than 5 [\_\_\_\_\_] years.

###### 1.4.1.1 Manufacturer's Technical Representative

The manufacturer's technical representative must be thoroughly familiar with the products to be installed, installation requirements and practices, and with any special considerations in the geographical area of the project. The representative must perform field inspections and attend meetings as specified.

###### 1.4.1.2 Single Source

Provide roofing panels, clips, closures, and other accessories that are standard products of the same manufacturer, and the most recent design of the manufacturer to operate as a complete system for the intended use.

##### 1.4.2 Qualification of Applicator

Metal roof system applicator must be approved, authorized, or licensed in writing by the roof panel manufacturer and have a minimum of [three] [\_\_\_\_\_] years experience as an approved, authorized, or licensed applicator with that manufacturer, approved at a level capable of providing the specified warranty. Supply the names, locations and client contact information of 5 projects of similar size and scope constructed by applicator using the manufacturer's roofing products submitted for this project within the previous three years.

##### 1.4.3 Field Verification

Prior to the preparation of drawings and fabrication, verify location of roof framing, roof openings and penetrations, and any other special conditions. Indicate all special conditions and measurements on final shop drawings.

##### 1.4.4 Qualifications for Welding Work

Perform welding procedures in conformance to AWS D1.1/D1.1M for steel or AWS D1.2/D1.2M for aluminum.

Operators are permitted to make only those types of weldments for which each is specifically qualified.

##### 1.4.5 Pre-roofing Conference

After approval of submittals and before performing roofing system installation work, hold a pre-roofing conference to review the following:

- a. Drawings, specifications, and submittals related to the roof work. Submit, as a minimum; sample profiles of roofing panels, with factory-applied color finish samples, flashing and accessories, gutter/downspout assembly samples, typical fasteners and pressure sensitive tape, sample gaskets and sealant/insulating compounds. Also include data and 1/2 pint sample of [aluminized steel repair paint] [enamel repair paint] [galvanizing repair paint], and technical data on coil stock and coil stock compatibility, and manufacturer's installation manual.
- b. Roof system components installation;
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;
- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and
- e. Quality control plan for the roof system installation;
- f. Safety requirements.

Coordinate pre-roofing conference scheduling with the Contracting Officer. Attendance is mandatory for the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of metal roof system, flashing and sheet metal work, [[mechanical] [and] [electrical] work], other trades interfacing with the roof work, and representative of the metal roofing manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

#### 1.4.6 Engineering Calculations

Provide engineering services by an authorized engineer, currently licensed in the geographic area of the project, with a minimum of five years experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for MBMA RSDM, ASCE 7-16, UL 580, and FM 4471. Engineer must provide certified engineering calculations for the project conforming to the stated references.

#### 1.5 DELIVERY, HANDLING, AND STORAGE

Deliver, store, and handle panel materials, bulk roofing products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.

##### 1.5.1 Delivery

Package and deliver materials to the site in undamaged condition. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, deformation, dampness, and staining. Remove affected materials from the site and

immediately replace. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

#### 1.5.2 Handling

Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or applied roofing.

#### 1.5.3 Storage

Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store roof panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Secure coverings and stored items to protect from wind displacement.

#### 1.6 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements, and specified safety requirements.

#### 1.7 FABRICATION

Fabricate and finish metal roof panels and accessories on a [factory stationary industrial type] [leased or installer owned portable] rolling mill to the greatest extent possible, per manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements.

Provide panel profile, as indicated on drawings [including major ribs ] [and intermediate stiffening ribs ] for full length of panel. Fabricate panel side laps with factory installed [captive gaskets] [separator strips] providing a weather tight seal and preventing metal-to metal contact, and minimizing noise from movements within the panel assembly.

##### 1.7.1 Finishes

Finish quality and application processes must conform to the related standards specified within this section. Noticeable variations within the same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize any contrasting variations.

##### 1.7.2 Accessories

Fabricate flashing and trim to comply with recommendations in [SMACNA 1793](#) as applicable to the design, dimensions, metal, and other characteristics of the item indicated.

- a. Form exposed sheet metal accessories which are free from excessive oil canning, buckling, and tool marks, and are true to line and levels indicated, with exposed edges folded back to form hems.
- b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. [ Rivet joints for additional

strength.]

- c. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with [SMACNA 1793](#).
- d. Conceal fasteners and expansion provisions where possible. [ Exposed fasteners are not allowed on faces of accessories exposed to view.]
- e. Fabricate cleats and attachments devices of size and metal thickness recommended by SMACNA or by metal roof panel manufacturer for application, but not less than the thickness of the metal being secured.

## 1.8 WARRANTIES

Provide metal roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to manufacturer's standard warranty as required to comply with the specified requirements.

### 1.8.1 Metal Roof Panel Manufacturer Warranty

Furnish the metal roof panel manufacturer's [5] [10] [\_\_\_\_\_] [20] [30]-year no dollar limit roof system materials and installation workmanship warranty, including flashing, [insulation, ]components, trim, and accessories necessary for a watertight roof system construction. Make warranty directly to the Government, commencing at time of Government's acceptance of the roof work. The warranty must state that:

- a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer.
- b. If the manufacturer or his approved applicator fail to perform the repairs within [24] [48] [72] hours of notification, emergency temporary repairs performed by others does not void the warranty.

### 1.8.2 Manufacturer's Finish Warranty

Provide a manufacturer's no-dollar-limit 20 year warranty for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance, warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with [ASTM D4214](#); or fade or change colors in excess of 5 NBS units as measured in accordance with [ASTM D2244](#).

### 1.8.3 Metal Roof System Installer Warranty

Provide the "Contractors [Five] [Ten] [Twenty] [5] [10] [20]) Year No Penal Sum Warranty for Non-Structural Metal Roof System" attached at the end of this section. [Provide a separate bond in an amount equal to the installed total material and installation roofing system cost in favor of the

Government covering the installer's warranty responsibilities effective throughout the [five] [ten] [twenty] [5] [10] [20]) year warranty period.]

Provide roof system installer warranty for a period of not less than [two] [five] years that the roof system, as installed, is free from defects in installation workmanship, to include the roof panel installation, flashing, [insulation,] accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Issue warranty directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials is the responsibility of the metal roof system installer. All costs associated with the repair or replacement work are the responsibility of the installer.

#### 1.8.4 Continuance of Warranty

Repair or replacement work that becomes necessary within the warranty period must be approved, as required, and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the metal roof system manufacturer warranty for the remainder of the manufacturer warranty period.

#### 1.9 CONFORMANCE AND COMPATIBILITY

Provide the entire metal roofing and flashing system in accordance with specified and indicated requirements, including wind resistance [and seismic per [AISC 341](#)] requirements. Perform work not specifically addressed and any deviation from specified requirements in general accordance with recommendations of the [MBMA RSDM](#), [NRCA RoofMan](#), the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

### PART 2 PRODUCTS

#### 2.1 ROOF PANELS

##### 2.1.1 Aluminum Sheet Panels

Roll-form aluminum roof panels to the specified profile, with  $f_y = [30] [40] [50] [80]$  ksi,  $[.032] [.040] [.050]$  inch thickness and depth as indicated.

Provide aluminum panels with a minimum recycled content of 30 percent. Provide data indicating percentage of [recycled content for aluminum roof panels](#).

Material must be plumb and true, and within the tolerances listed:

- a. Aluminum sheet conforming to [ASTM B209](#), and [AA ADM](#)
- b. Individual panels to have continuous length sufficient to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not a part of the panel profile and free from damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified, and the following profile:

- (1) profile and coverage to be a minimum height and width from the



manufacturer's standard for the indicated roof slope.

- (2) profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall panel width with 36 inch exposed panel and exposed fasteners.
- (3) profile to be a 1-1/2 inch high rib at 7.2 inches o.c.; 38-7/8 inch overall width with 36 inch exposed panel and exposed fasteners.
- (4) profile to be a 1 inch high rib at 4 inches o.c.; 49-5/8 inch overall width with [48] [44] inch exposed panel and exposed fasteners.
- (5) profile to be a 1 inch high rib at 8 inches o.c.; 41-5/8 inch overall width with 40 inch exposed panel and exposed fasteners.
- (6) profile to be a 1-3/4 inch high V-beam rib at 5 inches o.c.; 44-7/8 inch overall width with 42 inch exposed panel and exposed fasteners.
- (7) profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch exposed panel and exposed fasteners.
- (8) profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.
- (9) profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] [24] inch coverage with mechanical crimping or snap-together seams with concealed clips and fasteners.
- (10) profile to be [smooth, flat] [embossed pattern] [textured] surface.
- (11) profile to be custom, as shown on drawings.

#### 2.1.2 Steel Sheet Panels

Roll-form steel sheet roof panels to the specified profile, with  $f_y = [30] [40] [50] [80]$  ksi, [26] [24] [22] [20] [18] gauge and depth as indicated.

Provide steel panels with a minimum recycled content of 30 percent. Provide data indicating percentage of recycled content for steel roof panels.

Material must be plumb and true, and within the tolerances listed:

- a. Galvanized steel sheet conforming to ASTM A653/A653M and AISI SG03-3.
- b. Aluminum-Zinc alloy coated steel sheet conforming to ASTM A792/A792M and AISI SG03-3.
- c. Individual panels to have continuous length sufficient to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not a part of the panel profile and free from damage to the finish coating system.
- d. Provide panels with thermal expansion and contraction consistent with the type of system specified, and the following profile:

- (1) profile and coverage to be a minimum height and width from the manufacturer's standard for the indicated roof slope.
- (2) profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall panel width with 36 inch exposed panel and exposed fasteners.
- (3) profile to be a 1-1/2 inch high rib at 7.2 inches o.c.; 38-7/8 inch overall width with 36 inch exposed panel and exposed fasteners.
- (4) profile to be a 1 inch high rib at 4 inches o.c.; 49-5/8 inch overall width with [48] [44] inch exposed panel and exposed fasteners.
- (5) profile to be a 1 inch high rib at 8 inches o.c.; 41-5/8 inch overall width with 40 inch exposed panel and exposed fasteners.
- (6) profile to be a 1-3/4 inch high V-beam rib at 5 inches o.c.; 44-7/8 inch overall width with 42 inch exposed panel and exposed fasteners.
- (7) profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch exposed panel and exposed fasteners.
- (8) profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] [24] inch coverage with mechanical crimping or snap-together seams with concealed clips and fasteners.
- (9) profile to be [smooth, flat] [embossed pattern] [textured] surface.
- (10) profile to be custom, as shown on drawings.

## 2.2 FACTORY FINISH AND COLOR PERFORMANCE REQUIREMENTS

All panels are to receive a factory applied [polyvinylidene fluoride] [Kynar 500/Hylar 5000] [\_\_\_\_\_] finish consisting of a baked topcoat with a manufacturer's recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.
- b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. Oven cure the prime coat prior to application of the finish coat.
- c. Exterior Finish Coating: Apply the exterior finish coating over the primer by roll coating to a dry film thickness of 0.80 plus 0.05 mils (3.80 plus 0.05 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol). Oven cure this exterior finish coat.
- d. Interior finish coating: Apply a wash coat on the reverse side over primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. Oven cure the

wash coat.

- e. Color: The exterior finish chosen from the manufacturer's standard color chart.
- f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General:	ASTM D5894 and ASTM D4587
Abrasion:	ASTM D968
Adhesion:	ASTM D3359
Chalking:	ASTM D4214
Chemical Pollution:	ASTM D1308
Color Change and Conformity:	ASTM D2244
Creepage:	ASTM D1654
Cyclic Corrosion Test:	ASTM D5894
Flame Spread:	ASTM E84
Flexibility:	ASTM D522/D522M
Formability:	ASTM D522/D522M
Gloss at 60 and 85 degrees:	ASTM D523
Humidity:	ASTM D2247 and ASTM D714
Oxidation:	ASTM D610
Pencil Hardness:	ASTM D3363
Reverse Impact:	ASTM D2794
Salt Spray:	ASTM B117
Weatherometer:	ASTM G152, ASTM G153 and ASTM D822

2.2.1 Specular Gloss

Finished roof surfaces to have a specular gloss value of [30 plus or minus 5 at an angle of 60 degrees] [10 or less at an angle of 85 degrees] when measured in accordance with ASTM D523.

2.2.2 Energy [and Cool Roof] Performance

[Provide a product that is Energy Star labeled and is produced and

compatible with the requirements of this specification. Provide data identifying [Energy Star label for metal roofing product.](#) [ The roofing system will need to include a top surface finish that meets the criteria for Cool Roof Products.] [ Provide emittance and reflectance percentages, solar reflectance index values, [ and ]slopes [\_\_\_\_\_], to meet sustainable third party certification requirements for [Heat Island Reduction.](#)]

## 2.3 MISCELLANEOUS METAL FRAMING

### 2.3.1 General

Provide cold formed metallic-coated steel sheet conforming to [ASTM A653/A653M](#), [AISI S100](#), and as specified in [05 40 00 COLD-FORMED METAL FRAMING](#) unless otherwise indicated.

### 2.3.2 Fasteners and Miscellaneous Metal Framing

Provide compatible type, corrosion resistant, of sufficient size and length to penetrate the supporting element a minimum of one inch with other required properties to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and [ASCE 7-16](#) requirements.

#### 2.3.2.1 Exposed Fasteners

Provide corrosion resistant [coated steel] [aluminum] [stainless steel] [nylon capped steel] fasteners for roof panels, compatible with the sheet panel or flashing material and of the type and size recommended by the manufacturer to meet the performance requirements and design loads. Provide fasteners for accessories that are the manufacturer's standard. Provide an integral metal washer, matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick for exposed fasteners.

#### 2.3.2.2 Screws

Provide corrosion resistant screws, [coated steel] [aluminum] [stainless steel] of the type and size recommended by the manufacturer to meet the performance requirements.

#### 2.3.2.3 Rivets

Provide closed-end type rivets, corrosion resistant [coated steel] [aluminum] [stainless steel] where watertight connections are required.

#### 2.3.2.4 Attachment Clips

Provide [hot-dip galvanized, conforming to [ASTM A653/A653M](#), ] [stainless steel, series 300] clips. Size, shape, thickness and capacity must meet the thickness and design load criteria specified.

### 2.3.3 Electrodes for Manual, Shielded Metal Arc Welding

Utilize electrodes for manual, shielded metal arc welding meeting the requirements of [AWS D1.1/D1.1M](#), that are covered, mild-steel electrodes conforming to [AWS A5.1/A5.1M](#).

## 2.4 ACCESSORIES

Provide accessories compatible with the metal roof panels. Sheet metal

flashing, trim, metal closure strips, caps, and similar metal accessories must be not less than the minimum thicknesses specified for roof panels. Provide exposed metal accessories to match the panels furnished[, except as otherwise indicated]. Provide molded foam rib, ridge and other closure strips that are closed-cell or solid-cell synthetic rubber or neoprene premolded to match configuration of the panels and not absorb or retain water.

#### 2.4.1 Pre-manufactured Accessories

Provide pre-manufactured accessories that are manufacturer's standard for intended purpose, [ comply with applicable specification section,] compatible with the metal roof system and approved for use by the metal roof panel manufacturer. Construct curbs to match roof slope.

#### 2.4.2 Metal Closure Strips

Provide factory fabricated [aluminum closure strips] [steel closure strips] of the same [gauge] [thickness], color, finish and profile as the specified roof panel.

#### 2.4.3 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber closure strips conforming to [ASTM D1056](#) and [ASTM D1667](#), extruded or molded to the configuration of the specified roof panel profile and in lengths supplied by roof panel manufacturer.

#### 2.4.4 Subgirts for Retrofits

Provide bar subgirts 1-1/2 by 1/8 inch galvanized steel with slotted holes for welding to end of impaling clip spikes.

### 2.5 JOINT SEALANTS

#### 2.5.1 Sealants

Sealants are to be an approved gun type for use in hand or air pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F) with a minimum solid content of 85 percent of the total volume. Ensure sealant dries with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather tight joint. No migratory staining, in conformance with to [ASTM C792](#), is permitted on painted or unpainted metal, stone, glass, vinyl or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof panel manufacturer.

##### 2.5.1.1 Shop Applied Sealants

Provide sealant for shop-applied caulking that is an approved gun grade, non-sag one-component polysulfide or silicone conforming to [ASTM C792](#) and [ASTM C920](#), Type II, with a curing time which ensures the sealants plasticity at the time of field erection. Color to match panel color.

##### 2.5.1.2 Field Applied Sealants

Provide sealants for field-applied caulking that is an approved gun grade,

non-sag on-component polysulfide or two component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to [ASTM C920](#), Type II. Color to match panel color.

#### 2.5.1.3 Tape Sealants

Provide pressure sensitive, 100 percent solid tape sealant with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

#### 2.5.2 Sheet Metal Flashing and Trim

##### 2.5.2.1 Fabrication, General

Custom fabricate sheet metal flashing and trim to comply with recommendations within the SMACNA 1793 that apply to design, dimensions, metal type, and other characteristics of design indicated. Shop fabricate items to the greatest extent possible. Obtain and verify field measurements for accurate fit prior to shop fabrication. Fabricate flashing and trim without excessive oil canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

##### 2.5.2.2 Roof Drainage Sheet Metal Fabrications

Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum [96 inch](#) long sections. Fabricate expansion joints and accessories from the same metal as gutters, unless otherwise indicated.

Downspouts: Fabricate [ circular ] [ rectangular ] [ square ] downspouts complete with mitered elbows. Furnish with metal hangers of same material as downspouts and anchors.

#### 2.6 INSULATION

Provide insulation, facer material and attachment compatible with metal roof system specified, as approved by the roof panel manufacturer, and conform to [ASTM C552](#) (cellular glass) or [ASTM C553](#) (fiber blankets).

##### 2.6.1 Fire Rated Assembly System

Provide semi-rigid glass-fiber insulation board conforming to [ASTM C553](#), Form A, Class 1, Class A fire-hazard classification with a minimum density of [1.55 pounds per cubic foot \(pcf\)](#) and [1-1/2 inches](#) thick. Thermal conductivity (K) must not exceed [0.24](#).

##### 2.6.2 Fire Rated Roof Panel Assembly

Provide materials for fire-rated roof panel construction as follows:

Provide impaling clips, accessories, and fasteners that are UL listed 40 U18.24 [UL Bld Mat Dir](#) galvanized steel sheet or impaling bolts welded to each wall unit joint and spaced not more than [48 inches](#) on center.

Provide bar subgirts [1-1/2 by 1/8 inch](#) galvanized steel with slotted holes for welding to end of impaling clip spikes.

Provide galvanized steel structural angles and flashing angles, gage or thickness as indicated, or material as specified. Flashing angles must be not less than No. 18 U.S. standard gage.

Provide hot-dip galvanized steel metal facing conforming to ASTM A653/A653M, Grade A. Coating in conformance with ASTM A653/A653M and ASTM A924/A924M.

Provide metal facing as indicated and fabricated of enamel-coated hot-dip galvanized steel conforming to ASTM A653/A653M, Grade A. Coating in conformance with ASTM A653/A653M and ASTM A924/A924M. Provide Class A fire hazard classification finish. Flame spread, fuel contributed, or smoke developed cannot exceed a value of 25.

Submit fire rating test report to contracting officer for review and approval. Secure written approval prior to commencement of installation.

## 2.7 UNDERLAYMENTS

### 2.7.1 Felt Underlayment

Provide No. 30 asphalt-saturated organic, non-perforated felt underlayment in compliance with ASTM D226/D226M, Type II, or ASTM D4869/D4869M.

### 2.7.2 Self-Adhering Modified Bitumen Underlayment

Provide self-adhering modified bitumen membrane underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal roofing. Use membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.

### 2.7.3 EPDM Membrane

Ethylene Propylene Diene Terpolymer (EPDM), ASTM D4637/D4637M, Type I, non-reinforced, minimum 0.045 inch thick.

### 2.7.4 Slip Sheet

Provide 5 pounds per 100 sf rosin sized unsaturated building paper for slip sheet.

## 2.8 GASKETS AND SEALING/INSULATING COMPOUNDS

Provide gaskets and sealing/insulating compounds that are nonabsorptive and suitable for insulating contact points of incompatible materials. Utilize sealing/insulating compounds that are non-running after drying.

## 2.9 FINISH REPAIR MATERIAL

Provide repair paint for color finish enameled roofing that is compatible paint of the same formula and color as the specified finish furnished by the manufacturer.

Only use repair and touch-up paint supplied by the roof panel manufacturer and is compatible with the specified system.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work. Ensure surfaces are suitable, dry and free of defects and projections which might affect the installation.

Examine primary and secondary roof framing to verify that rafters, purlins, angels, channels, and other structural support members for panels and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, and [ASCE 7-16](#) [ and applicable seismic] requirements.

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking; and that installation is within flatness tolerances required by metal roof panel manufacturer.

Examine rough-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of panels prior to installation.

Submit a written report to the Contracting Officer, endorsed by the installer, listing conditions detrimental to the performance of the work. Proceed with installation only after defects have been corrected.

Do not install items that show visual evidence of biological growth.

### 3.2 INSTALLATION

Perform installation meeting specified requirements and in accordance with the manufacturer's installation instructions and approved shop drawings. Do not install damaged materials. Insulate dissimilar materials which are not compatible when contacting each other by means of gaskets or sealing/insulating compounds. Keep all exposed surfaces and edges clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Remove stained, discolored, or damaged materials from the site.

#### 3.2.1 Preparation

Clean all substrate substances which may be harmful to [insulation, and ]roof panels including removing projections capable of interfering with [insulation, and ]roof panel attachment.

Install sub-purlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

#### 3.2.2 Underlayment

Install underlayment according to roof panel manufacturer's written recommendations and recommendation in NRCA "The NRCA Roofing and Waterproofing Manual".

##### 3.2.2.1 Single Layer Felt Underlayment for a Standard Slope Roof Deck

Install single layer of felt underlayment on roof deck perpendicular to



roof slope in parallel courses. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses a minimum of 72 inches. Fasten with felt underlayment roofing nails.

Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in a direction to shed water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.

#### 3.2.2.2 Self-Adhering Sheet Underlayment

Install self-adhering sheet underlayment; wrinkle free on roof deck. Comply with low-temperature installation restrictions of manufacturer where applicable. Install at locations indicated on project drawings, lapped in a direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

#### 3.2.2.3 Slip Sheet

[Apply specified slip sheet at time of roof panel installation when felt or other underlayment is used that may be in direct contact with and adhere to or adversely impact the underside of roof panels, and as otherwise recommended by the roof panel manufacturer.] [Install slip sheet over deck substrates prior to roof panel installation.]

### 3.3 INSULATION INSTALLATION

Install insulation concurrently with metal roof panel installation, in thickness indicated, to cover entire roof, according to manufacturer's written instructions.

### 3.4 PROTECTION OF APPLIED MATERIALS

Do not permit storing, walking, wheeling, and trucking directly on applied roofing/insulation materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing/insulation materials, and to distribute weight to conform to indicated live load limits of roof construction.

### 3.5 FASTENER INSTALLATION

Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions.

#### 3.5.1 Welding

Perform procedures for manual, shielded metal-arc welding, the inspection and testing of welds made, and the methods used in correcting welding work in accordance with AWS D1.1/D1.1M.

### 3.6 FLASHING, TRIM, AND CLOSURE INSTALLATION

#### 3.6.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where

possible. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently water tight and weather resistant. Work is to be accomplished to form weather tight construction without waves, warps, buckles, fastening stresses or distortion, and to allow for expansion and contraction. Perform cutting, fitting, drilling, and other operations in connection with sheet metal required to accomplish the work in conformance with the manufacturers written instructions.

### 3.6.2 Metal Flashing

Install exposed metal flashing at building corners, rakes, eaves, junctions between metal siding and roofing, valleys and changes off slope or direction in metal roofing, building expansion joints and gutters.

Utilize exposed metal flashing that is the same material, color, and finish as the specified metal roofing panels. Furnish flashing in minimum 8 foot lengths. Exposed flashing must have 1 inch locked and blind soldered end joints, with expansion joints at intervals of no greater than 16 feet.

Fasten flashing at not more than 8 inches on center for roofs, except where flashing is held in place by the same screws used to secure panels. Bed exposed flashing and flashing subject to rain penetration in specified joint sealant. Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

### 3.7 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels or other components of the Work securely in place, with provisions for thermal and structural movement in accordance with [NRCA 0420](#).

**Steel Roof Panels:** Use stainless steel fasteners for exterior surfaces and galvanized fasteners for unexposed surfaces.

**Aluminum Roof Panels:** Use aluminum or stainless steel fasteners for surfaces exposed to the exterior and aluminum or galvanized steel fasteners for unexposed surfaces.

**Anchor Clips:** Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions. Provide all blocking and nailers as required.

**Metal Protection:** Where dissimilar metals contact each other or possibly corrosive substrates, protect against galvanic action by [coating contact surfaces with a bituminous coating] [applying rubberized asphalt underlayment to each contact surface] [permanent separation as recommended by the metal roof panel manufacturer].

**Joint Sealers:** Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of metal roof panel system. Provide types of gaskets, fillers, and sealants indicated or,

if not indicated, types recommended by metal roof panel manufacturer.

### 3.7.1 Handling and Erection

Erect roofing system in accordance with the approved erection drawings, printed instructions and safety precautions of the manufacturer.

Do not subject panels to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective panels. Replace and remove from the site any damaged panels at the Contractor's expense. Erect panels true, plumb, and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with indicated rake, eave, and curb overhang. Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Do not permit storage, walking, wheeling or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of the roof construction.

Lay roof panels with corrugations in the direction of the roof slope. Lap ends of exterior roofing not less than 8 inches; lap sides of standard exterior corrugated panels not less than 2-1/2 corrugations.

Field cutting of metal roof panels by torch is not permitted. Field cut only as recommended by manufacturer's written instructions.

### 3.7.2 Closure Strips

Install metal closure strips at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof, unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.

Install closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

### 3.7.3 Workmanship

Make lines, arises, and angles sharp and true. Free exposed surfaces from any visible wave, warp, buckle and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of [SMACNA 1793](#). Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and as necessary to make the work watertight.

## 3.8 ACCEPTANCE PROVISIONS

### 3.8.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines must not vary more than 1/4 inch in 20 feet or 3/8 inch in 40 feet.

### 3.8.2 Leakage Tests

Finished application of metal roofing is to be subject to inspection and test for leakage by the Contracting Officer or his designated representative, and Architect/Engineer. Inspection and tests will be conducted without cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and removal/replacement of defective materials.

### 3.8.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials and as recommended by the metal roof panel manufacturer. Finished repaired surfaces must be uniform and free from variations of color and surface texture. Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

### 3.8.4 Paint Finished Metal Roofing

Paint finished metal roofing will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period. Remove and replace panels that indicate color changes, fading, or surface degradation, determined by visual examination with new panels at no expense to the Government. New panels will be subject to the specified tests for an additional year from the date of their installation.

## 3.9 CLEAN UP AND DISPOSAL

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish. [ Treat exposed cut edges with manufacturer supplied [clear] [\_\_\_\_\_] coat.]

Collect all scrap/waste materials and place in containers. Promptly dispose of demolished and scrap materials. Do not allow scrap/waste materials to accumulate on-site; transport immediately from the government property and legally dispose of them.

## 3.10 FIELD QUALITY CONTROL

### 3.10.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of [[three] [\_\_\_\_\_] times] [once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place. [ Make inspections during the first 20 squares of roof panel

installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections are required for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer.] After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

Submit three [\_\_\_\_\_] signed copies of the [manufacturer's field inspection reports](#) to the Contracting Officer within one week of substantial completion.

### 3.11 INFORMATION CARD

For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 0.032 inch thick aluminum card for exterior display. [Format as directed in paragraph FORM ONE.](#)

Make card 8 1/2 by 11 inches minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment(s), date of completion; installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install card at [interior roof top access point] [location as directed by the Contracting Officer] and provide a paper copy to the Contracting Officer.

#### 3.11.1 Form One

FORM 1 - PREFORMED [STEEL] [ALUMINUM] PANEL ROOFING SYSTEM AND COMPONENTS

- 1. Contract Number:
- 2. Building Number & Location:
- 3. NAVFAC Specification Number:
- 4. Deck/Substrate Type:
- 5. Slopes of Deck/Roof Structure:
- 6. Insulation Type & Thickness:
- 7. Insulation Manufacturer:
- 8. Vapor Retarder:     ( )Yes     ( )No
- 9. Vapor Retarder Type:
- 10. Preformed Steel Standing Seam Roofing Description:
  - a. Manufacturer (Name, Address, & Phone No.):
  - b. Product Name:
  - c. Width:
  - d. Gage:
  - e. Base Metal:
  - f. Method of Attachment:
- 11. Repair of Color Coating:
  - a. Coating Manufacturer (Name, Address & Phone No.):
  - b. Product Name:
  - c. Surface Preparation:
  - d. Recoating Formula:
  - e. Application Method:
- 12. Statement of Compliance or Exception: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- 13. Date Roof Completed:
- 14. Warranty Period: From \_\_\_\_\_ To \_\_\_\_\_
- 15. Roofing Contractor (Name & Address):
- 16. Prime Contractor (Name & Address):

Contractor's Signature \_\_\_\_\_ Date:

Inspector's Signature \_\_\_\_\_ Date:Text

3.12 DATE OF INSTALLATION WALL-MOUNTED PLACARD

For each metal roof panel installation, furnish an exterior "Date of Installation Placard", 0.032 inch thick [aluminum] [\_\_\_\_], 8-1/2 inches high by 11 inches wide, with mounting accessories, photoengraved to include the following information:

Facility Name and Number  
Approximate Roof Area Newly Installed and Date of Completion  
Manufacturer, Type of Roof Panel and Name  
Underlayment and Insulation System, R value  
Installing Contractor and Contact Information  
Warranty Expiration Date  
Warranty Reference Number and Contact Information

Install placard as directed by the Contracting Officer.

3.13 WARRANTY

CONTRACTOR'S [FIVE (5)] [TEN (10)] [TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_



CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM  
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY \_\_\_\_\_ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHING INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON \_\_\_\_\_ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President) (Date)

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOFING SYSTEM  
(continued)

THE CONTRACTOR MUST SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM. SUBMIT ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN MUST INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM  
(continued)

\*\*REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES MUST BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. INITIATE EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS IMMEDIATELY; SUBMIT A WRITTEN PLAN FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. COMMENCE ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

POST A FRAMED COPY OF THIS WARRANTY IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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## SECTION 07 41 63

## FABRICATED ROOF PANEL ASSEMBLIES

11/16

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA ADM (2020) Aluminum Design Manual

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341 (2016) Seismic Provisions for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (2017) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A424/A424M (2009a; R 2016) Standard Specification for Steel Sheet for Porcelain Enameling

ASTM A463/A463M (2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A606/A606M (2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy,

	Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755/A755M	(2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B659	(1990; R 2021) Standard Guide for Measuring Thickness of Metallic and Inorganic Coatings
ASTM C273/C273M	(2020) Standard Test Method for Shear Properties of Sandwich Core Materials
ASTM C286	(2022) Standard Terminology Relating to Porcelain Enamel and Ceramic-Metal Systems
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1396/C1396M	(2017) Standard Specification for Gypsum Board
ASTM D522/D522M	(2017) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D822	(2013; R 2018) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D1622	(2014) Apparent Density of Rigid Cellular Plastics
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of

## Exterior Paint Films

ASTM D6226	(2015) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E2140	(2001; R 2017) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM G152	(2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

## FM GLOBAL (FM)

FM 4471	(2010) Class I Panel Roofs
FM 4474	(2014) Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures

## METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA RSDM	(2012) Metal Roofing Systems Design Manual
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## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual
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## NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0429	(2014) The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control and Reroofing
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- NRCA RoofMan** (2020) The NRCA Roofing Manual  
 PORCELAIN ENAMEL INSTITUTE (PEI)
- PEI 1001** (1996) Specification for Architectural  
 Porcelain Enamel (ALS-100)  
 SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
 (SMACNA)
- SMACNA 1793** (2012) Architectural Sheet Metal Manual,  
 7th Edition  
 SOCIETY FOR PROTECTIVE COATINGS (SSPC)
- SSPC PS 9.01** (1982; E 2004) Cold-Applied Asphalt Mastic  
 Painting System with Extra-Thick Film  
 UNDERWRITERS LABORATORIES (UL)
- UL 580** (2006; Reprint Mar 2019) UL Standard for  
 Safety Tests for Uplift Resistance of Roof  
 Assemblies

## 1.2 DEFINITIONS

Fabricated Roof Panel Assembly: Metal roof and liner panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories shop-fabricated or field-assembled for a complete weathertight roofing system.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Qualification of Manufacturer; G[, [\_\_\_\_]]

Qualification of Installer; G[, [\_\_\_\_]]

Qualifications for Welding; G[, [\_\_\_\_]]

Work Plan; G[, [\_\_\_\_]]

On-Site Inspection and Acceptance Procedure; G[, [\_\_\_\_]]

### SD-02 Shop Drawings

Roofing Panels; G[, [\_\_\_\_]]

Flashing and Accessories; G[, [\_\_\_\_]]

Gutter/Downspout Assembly; G[, [\_\_\_\_]]

## SD-03 Product Data

Sustainable Acquisition; G[, [\_\_\_\_]].

Coil Stock; G[, [\_\_\_\_]]

Factory Color Finish; G[, [\_\_\_\_]]

Sub-girts and Formed Shapes; G[, [\_\_\_\_]]

Closure Materials; G[, [\_\_\_\_]]

Insulation; G[, [\_\_\_\_]]

Pressure-Sensitive Tape; G[, [\_\_\_\_]]

Sealants and Caulking; G[, [\_\_\_\_]]

Rated Wall Assembly; G[, [\_\_\_\_]]

[ Galvanizing Repair Paint; G[, [\_\_\_\_]]

] [ Enamel Repair Paint; G[, [\_\_\_\_]]

] [ Aluminized Steel Repair Paint; G[, [\_\_\_\_]]

] Accessories; G[, [\_\_\_\_]]

## SD-04 Samples

Coil Stock; G[, [\_\_\_\_]]

Roofing Panels; G[, [\_\_\_\_]]

Fasteners; G[, [\_\_\_\_]]

Metal Closure Strips; G[, [\_\_\_\_]]

Insulation; G[, [\_\_\_\_]]

Manufacturer's Color Charts and Chips; G[, [\_\_\_\_]]

## SD-05 Design Data

Wind Design Analysis

[ Seismic Design Analysis

## ] SD-06 Test Reports

Leakage Tests; G[, [\_\_\_\_]]

[ Fire Rating Test Report; G[, [\_\_\_\_]]

] Coatings and Base Metals of Metal Roofing; G[, [\_\_\_\_]]

Factory Finish and Color Performance Requirements; G[, [\_\_\_\_]]

[ Wind Uplift Test Report; G[, [\_\_\_\_]]

] [ Seismic Test Report; G[, [\_\_\_\_]]

] SD-07 Certificates

Coil Stock

Fasteners

[ Galvanizing Repair Paint

] [ Enamel Repair Paint

] Safety Data Sheets

Coating Physical Properties:

SD-08 Manufacturer's Instructions

Installation of Roof Panel Assemblies

SD-11 Closeout Submittals

Warranty

Information Form and Placard; G[, [\_\_\_\_]]

Manufacturer's Field Inspection Reports

Application Instructions

Date of Installation Wall-Mounted Placard; G

20-year "No-Dollar-Limit" Warranty for Labor and Materials; G

#### 1.4 QUALITY CONTROL

##### 1.4.1 Preroofing Conference

After submittals are received and approved but before roofing and insulation work, including associated work, is performed, the Contracting Officer will hold a preroofing conference to review the following:

a. The drawings and specifications:

- (1) Fabrication and installation drawings for the following items are to indicate completely dimensioned structural frame and erection layouts, openings in the roof, special framing details and construction details at corners, ridges, eaves, building intersections, curbs and flashing, location and type of mastic and metal filler strips, location and erection of flashing and gutter/downspout assembly.
- (2) Installation of roof panel assemblies
- (3) Roofing panels, submit sample 12 inches long by actual panel width
- (4) Flashing and accessories, submit sample 10 inches long of each type

(5) Gutter/downspout assembly

Submit certification from the coil stock manufacturer or supplier that the machinery used will form the provided coil stock without warping, waviness, or rippling that is not a part of the panel profile, and without damage, abrasion or marring of the finish coating, and certification of conformance with the standards specified herein. Submit a sample 12 inches long by the actual panel width.

Submit the manufacturer's color charts and chips, approximately 4 by 4 inches, showing the full range of colors, textures and patterns available for roof panels with the factory color finish.

Submit factory finish and color performance requirements verified by an independent testing agency.

Submit a wind design analysis from the manufacturer including wind speed, exposure category, coefficient, importance factor. Designate a type of facility, negative pressures for each zone, methods and requirements of attachment. Include a roof plan delineating dimensions and attachment patterns for each zone. Include a signed and sealed wind design analysis with a Licensed project engineer, in the geographic area where the construction will take place.

[ (6) Wind Uplift Test Report

] [ (7) Seismic Design Analysis

] [ (8) Seismic Test Report

] (9) Fire Rating Test Report

b. Qualifications including:

(1) Qualification of Manufacturer

(2) Qualification of Installer

(3) Qualifications for Welding

c. Submit an on-site inspection and acceptance procedure of the roofing substrate and pertinent structural details relating to the roofing system, including:

(1) Safety Data Sheets

(2) Sub-girts and Formed Shapes

(3) Closure Materials

(4) Insulation

(5) Pressure-Sensitive Tape

(6) Sealants and Caulking

(7) Rated Wall Assembly

- [ (8) Galvanizing Repair Paint
- ][ (9) Enamel Repair Paint
- ][ (10) Aluminized Steel Repair Paint
- ] (11) Accessories

- d. Submit a [work plan](#) for coordination of the various trades involved in providing the roofing system and other components secured to the roofing.

Include detailed [application instructions](#) and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing the differences between the manufacturer's instructions and the specified requirements.

- e. Safety requirements
- f. Submit manufacturer's data indicating the percentage of recycle material in roofing panels to verify [sustainable acquisition](#) compliance.

#### 1.4.2 Manufacturer's Technical Representative

Ensure the representative has authorization from the manufacturer to approve field changes and is thoroughly familiar with the products and installations in the geographical area where construction will take place.

#### 1.4.3 Qualification of Manufacturer

Guarantee the metal roof panel system manufacturer possesses the following:

- a. A minimum of five years of experience in manufacturing metal roof system and accessory products.
- b. Engineering services of an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four years of experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for the [MBMA RSDM](#); [ASCE 7-16](#), [UL 580](#) and [FM 4474](#) FM wind design guide for metal roof systems.
- c. Certified engineering calculations using the products submitted for wind uplift requirements in accordance with [FM 4474](#) and [ASCE 7-16](#).

#### 1.4.4 Qualification of Installation Contractor

Confirm that the installation contractor is approved and certified by the roofing panel manufacturer before installing the metal roofing system.

#### 1.4.5 Qualifications for Welding

Provide certification of welding procedures conforming to [AWS A5.1/A5.1M](#) and [AWS D1.1/D1.1M](#)

#### 1.4.6 Single-Source

Obtain each type of metal roof and liner panels, clips, closures and other accessories from the standard products of the single-source manufacturer to

ensure these items operate as a complete system for the intended use.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver components, sheets, metal roof panels, and other manufactured items, handling them in a manner to prevent damage or deformation; package metal roof panels for protection during transportation and handling.

Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack metal roof panels on platforms or pallets, covered with a suitable weather-tight and ventilated covering; store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

Protect the strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for the period of metal roof panel installation.

Protect foam-plastic insulation as follows:

- a. Do not expose the foam-plastic insulation to sunlight, except to extent necessary for period of installation and concealment.
- b. Protect the foam-plastic insulation against ignition at all times. Do not deliver foam-plastic insulation materials to the project site before installation time.

Complete installation and concealment of plastic materials as rapidly as possible.

#### 1.6 PROJECT/SITE CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to the manufacturer's written instructions and warranty requirements.

Field Measurements: Verify the actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

#### 1.7 WARRANTY

Furnish the metal roof panel manufacturer's [5] [10] [\_\_\_\_\_] [20] [30]-year [no dollar limit] roof system materials and installation workmanship warranty, including flashing, [insulation, ] components, trim, and accessories necessary for a watertight roof system construction. Issue the warranty directly to the Government, such that the warranty takes effect at the time of the Government's acceptance of the roof work. Provide a warranty with the following conditions:

- a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes nonwater-tight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof

system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer. Conform galvanized repairs to [ASTM A780/A780M](#).

- b. If the manufacturer or the applicator approved by the manufacturer fail to perform the repairs within [24] [48] [72] hours of notification, emergency temporary repairs performed by others does not void the warranty.

#### [1.7.1 Manufacturer's Finish Warranty

Provide a manufacturer's 20-year "No-Dollar-Limit" Warranty for Labor and Materials for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance, warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with [ASTM D4214](#); or fade or change colors in excess of 5 NBS units as measured in accordance with [ASTM D2244](#).

#### ]1.7.2 Metal Roof System Installer Warranty

Provide the "Contractors [Five] [Ten] [Twenty] [5] [10] [20]) -Year No Penalty Sum Warranty for Non-Structural Metal Roof System" attached at the end of this section. [Provide a separate bond in an amount equal to the installed total material and installation roofing system cost in favor of the Government covering the installer's warranty responsibilities effective throughout the [five] [ten] [twenty] [5] [10] [20]) -year warranty period.]

Provide roof system installer warranty for a period of not less than [two] [five] years that the roof system, as installed, is free from defects in installation workmanship, including the roof panel installation, flashing, [insulation,] accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Issue warranty directly to the Government. Issue a statement that correction of defective workmanship and replacement of damaged or affected materials is the responsibility of the metal roof system installer. Also state that all costs associated with the repair or replacement work are the responsibility of the installer.

#### 1.7.3 Continuance of Warranty

Approve and accomplish repair or replacement work that becomes necessary within the warranty period to restore the integrity of the roof system assembly and maintain the validity of the metal roof system manufacturer's warranty for the remainder of the manufacturer warranty period.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Conformance and Compatibility

Provide an entire roofing and flashing system in accordance with specified and indicated requirements, including wind resistance [and seismic per [AISC 341](#) ] requirements. Perform any work not specifically addressed, or any deviation from specified requirements in general accordance with recommendations of the [MBMA RSDM](#), [NRCA RoofMan](#), the metal panel manufacturer's published recommendations and details, and compatible with

surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval before installation.

#### 2.1.1.2 Performance Requirements

- a. Hydrostatic-Head Resistance: No water penetration when tested according to [ASTM E2140](#).
- b. Wind-Uplift Resistance: Provide roof panel assemblies that comply with the requirements of the roof systems and attachments in accordance with [ASTM E1592](#) and [UL 580](#). Ensure that uplifting force caused by wind action governs the design for panels. Ensure that roof systems and attachments are to resist the wind loads as determined by [ASCE 7-16](#).
- c. FMG Listing: Provide FRP roof panels and component materials that comply with the requirements in [FM 4471](#) as part of a panel roofing system. Identify materials with FMG markings.
- d. Structural Performance: Provide roof panel assemblies capable of withstanding the effects of gravity loads and stresses within limits and under conditions indicated, based on testing according to [ASTM E1592](#).
- [ e. Seismic Performance: Provide fabricated roof panel assemblies conforming to [AISC 341](#) and the test data confirming compliance.

#### ]2.1.1.3 Fire-Resistance

##### 2.1.1.3.1 Surface-Burning Characteristics

Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to [ASTM E84](#) by a qualified testing agency. Identify products with the appropriate markings of an applicable testing agency.

Flame-Spread Index: [25] [\_\_\_\_\_] or less.

Smoke-Developed Index: [450] [\_\_\_\_\_] or less.

##### 2.1.1.3.2 Fire-Resistance Ratings

Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance by a qualified testing agency in accordance with [ASTM E119](#). Identify products with the appropriate markings of the applicable testing agency.

Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency. Combustion Characteristics: [ASTM E136](#).

## 2.2 FABRICATION

### 2.2.1 Fabrication

Fabricate and finish metal roof panels and accessories at the factory to the greatest extent possible, using the manufacturer's standard procedures and processes to fulfill the indicated performance requirements. Comply with indicated profiles, and dimensional and structural requirements



conforming to [AISI D100](#).

Provide a panel profile, including major ribs and intermediate stiffening ribs, if any, for the full length of panel.

Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within the panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in [SMACNA 1793](#) that apply to the design, dimensions, metal, and other characteristics of the item indicated.

Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks, and true to the line and levels indicated, with exposed edges folded back to form hems.

End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant, compliant with [SMACNA 1793](#).

Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on the faces of accessories exposed to view.

Fabricate cleats and attachment devices of the size and metal thickness recommended by [SMACNA 1793](#) or by the metal roof panel manufacturer for application, but not less than the thickness of the metal being secured.

## 2.2.2 Sheet Metal Flashing and Trim

### 2.2.2.1 Fabrication, General

Custom-fabricate sheet metal flashing and trim to comply with the recommendations in [SMACNA 1793](#) that apply to the design, dimensions, metal, and other characteristics of the items indicated. Shop-fabricate items where practicable. Obtain field measurements for an accurate fit before shop fabrication.

### 2.2.2.2 Roof Drainage Sheet Metal Fabrications

Fabricate gutters to the cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in [96-inch](#) long sections at a minimum. Fabricate expansion joints and accessories from the same metal as the gutters, unless otherwise indicated.

Fabricate [circular] [rectangular] downspouts complete with mitered elbows. Furnish with metal hangers, fabricated from the same material as the downspouts and anchors.

### 2.2.3 Finishes

Comply with [NAAMM AMP 500](#) for recommendations for applying and designating finishes.

Appearance of Finished Work: Ensure that there are no noticeable

variations in finish on the same piece. Variations in the appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

## 2.3 COMPONENTS

### 2.3.1 Miscellaneous Metal Framing

#### 2.3.1.1 General

Provide cold-formed metallic-coated steel sheet conforming to [AISI D100](#) and [ASTM A653/A653M](#) and specified in Section [05 40 00 COLD-FORMED METAL FRAMING](#) unless otherwise indicated.

#### 2.3.1.2 [Fasteners](#) for Miscellaneous Metal Framing

Provide fasteners of a type, material, corrosion resistance, size, and sufficient length to penetrate the supporting member a minimum of [1 inch](#) and possessing the other properties required to fasten miscellaneous metal framing members to substrates in accordance with the roof-panel manufacturer's and [ASCE 7-16](#) requirements.

### 2.3.2 Fasteners

#### 2.3.2.1 General

Provide fasteners of a type, material, corrosion resistance, size, and sufficient length to penetrate the supporting member a minimum of [1 inch](#) and possessing the other properties required to fasten miscellaneous metal framing members to substrates in accordance with the roof-panel manufacturer's and [ASCE 7-16](#) requirements.

#### 2.3.2.2 Exposed Fasteners

Provide corrosion-resistant coated steel, aluminum, stainless steel, or nylon-capped, steel-compatible exposed fasteners, with the sheet panel or flashing. Provide exposed fasteners of a type and size recommended by the manufacturer to meet the performance requirements and design loads specified. Provide the manufacturer's standard fasteners for accessories. Provide an integral metal washer that matches the color of material the washer is attached to with a compressible sealing EPDM gasket approximately [3/32 inch](#) thick.

#### 2.3.2.3 Screws

Provide corrosion-resistant coated steel, aluminum or stainless steel screws of the type and size recommended by the manufacturer to meet the performance requirements.

#### 2.3.2.4 Rivets

Provide closed-end rivets, made of corrosion-resistant coated steel, aluminum, or stainless steel where watertight connections are required.

#### 2.3.2.5 Attachment Clips

Provide clips fabricated from steel hot-dipped galvanized in accordance with [ASTM A653/A653M G 90](#) or Series 300 stainless steel. Ensure that the size, shape, thickness and capacity are as required to meet the insulation

thickness and design load criteria specified.

## 2.4 MATERIALS

### [2.4.1 Aluminum Sheet

Roll-form aluminum roof and liner panels to the specified profile, with  $f_y$  equals to a [30] [40] [50] [80] ksi, [.032] [.040] [.050] inch thickness and depth as indicated. Ensure that the material is plumb and true, and within the tolerances listed:

- a. Aluminum Sheet conforming to ASTM B209, ASTM B209M, and AA ADM.
- b. Ensure individual panels have continuous length to that covers the entire length of any unbroken roof slope with no joints or seams, formed without warping, waviness, or ripples that are not part of the panel profile, and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction coefficients consistent with the type of system specified.
  - [ (1) Provide profile and coverage of minimum height and width based on the manufacturer's standard for the indicated roof slope.
  - ][ (2) Provide a profile of 1 1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.
  - ][ (3) Provide a profile of 1 1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
  - ][ (4) Provide a profile of 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.
  - ][ (5) Provide a profile of 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.
  - ][ (6) Provide a profile of 1 3/4 inch high V-beam rib at 5 inches o.c., 44 7/8 inch overall width with 42 inch coverage and exposed fasteners.
  - ][ (7) Provide a profile of 7/8 inch high corrugated rib at 2 inches 38 7/8 inch overall width with 36 inch coverage and exposed fasteners.
  - ][ (8) Provide a profile of 3 inch high standing seam, 24 inch coverage, factory-caulked and with mechanical crimping or snap-together seams with concealed clips and fasteners.
  - ][ (9) Provide a profile of [1] [1 3/4] [2] [2 1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.
  - ][ (10) Provide a [smooth, flat] [embossed] surface texture.

### ][2.4.2 Steel Sheet

Provide roll-form steel roof and liner panels to the specified profile, with  $f_y$  equal to [30] [40] [50] [80] ksi, [26] [24] [22] [20] [18] gauge

and depth as indicated, conforming to ASTM A1008/A1008M, ASTM A36/A36M. Ensure the material is plumb and true, and within the tolerances listed:

- [ a. Galvanized/Galvannealed steel sheet conforming to ASTM A123/A123M, ASTM A653/A653M, ASTM A792/A792M, and AISI D100.
- ] b. Metallic coated steel sheet in accordance with ASTM A924/A924M.
- [ c. Aluminum-Zinc Alloy-coated sheet steel in accordance with ASTM A463/A463M, ASTM A755/A755M, ASTM A792/A792M and AISI D100.
- ] [d. Steel sheet with porcelain coating in accordance with ASTM A424/A424M, ASTM C286, and PEI 1001, or ASTM A606/A606M for improved atmospheric corrosion resistance.
- ] e. Provide individual panels with a continuous length that covers the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- f. Provide panels with thermal expansion and contraction consistent with the type of system specified.
- [ (1) Profile and coverage: a minimum height and width from manufacturer's standard for the indicated roof slope.
- ] [ (2) Profile: a 1 1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.
- ] [ (3) Profile: a 1 1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
- ] [ (4) Profile: a 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.
- ] [ (5) Profile: a 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.
- ] [ (6) Profile: a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
- ] [ (7) Profile: a 3 inch high standing seam, 24 inch coverage, factory-caulked and with mechanical crimping or snap-together seams with concealed clips and fasteners.
- ] [ (8) Profile: a [1] [1 3/4] [2] [2 1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.
- ] [ (9) Provide [smooth, flat] [embossed] surface texture.
- ]] [2.4.3 Foam-Insulation Core Roof Panel

Provide factory-formed [aluminum] [steel] roof panel assembly fabricated from two sheets of metal with modified polyisocyanurate or polyurethane foam insulation core [foamed-in-place] [board] during fabrication with joints between panels designed to form weather-tight seals. Include accessories required for weather-tight installation.

- a. Closed-Cell Content: 90 percent when tested according to [ASTM D6226](#).
- b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to [ASTM D1622](#).
- c. Compressive Strength: Minimum 20 psi when tested according to [ASTM D1621](#).
- d. Shear Strength: 26 psi when tested according to [ASTM C273/C273M](#).

#### ]2.4.4 Insulated Panel Construction

Shop-fabricate or field-assemble insulated panel construction with specified exterior and interior [aluminum] [steel] sheet in accordance with manufacturer's printed instructions.

Provide pre-finished interior lath- or board-finished interior surfaces for panel assemblies in accordance with [ASTM C1396/C1396M](#).

Provide [glass-fiber] [slag-wool-fiber] [rock-wool-fiber] insulation conforming to [ASTM C553](#) and [ASTM C612](#) of thickness and density as required for the geographical area where construction will take place. Glass-fiber and mineral-wool-fiber are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG)

<https://www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products>  
Submit a sample of insulation approximately 8 inches by 11 inches.

Provide adhesively attached insulation fasteners plate-welded to projecting spindle anchors, capable of holding insulation of thickness indicated, secured in position with self-locking washers and complying with the following requirements:

- a. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
- b. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- c. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with a beveled edge for increased stiffness, sized as required to hold insulation in place, but not less than 1 1/2 inches square or in diameter.
- d. Adhesive: Provide an anchor adhesive to bond insulation anchors to the substrates indicated without damaging insulation, fasteners, and substrates.

#### 2.4.5 Finish

Ensure all panels receive a factory-applied [polyvinylidene fluoride] [Kynar 500/Hylar 5000] [\_\_\_\_\_] finish consisting of a baked-on top-coat and a manufacturer's recommended prime coat with to the following:

- a. Metal Preparation: Prepare all metal surfaces for painting on a continuous process coil coating line by alkali cleaning, hot-water rinsing, application of chemical conversion coating, cold-water rinsing, sealing with acid rinse, and thorough drying.
- b. Prime Coating: Apply a base-coat of epoxy paint, specifically

formulated to interact with the top-coat, to the prepared surfaces by roll-coating the paint to a dry film thickness of 0.20 mils plus 0.05 mils. Ensure that the prime coat is oven-cured before the application of finish coat is applied.

- c. Exterior Finish Coating: Apply the finish coating over the primer by roll-coating the finish coating to a dry film thickness of 0.80 plus 5 mils (3.80 plus 0.50 mils for Vinyl Plastisol) for a total dry-film thickness of 1.00 mils plus 0.10 mils (4.00 mils plus 0.10 mils for Vinyl Plastisol). Ensure that the finish coat is oven-cured.
- d. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll-coating to a dry-film thickness of 0.30 mils plus 0.05 mils for a total-dry film thickness of 0.50 mils plus 0.10 mils. Ensure that the wash-coat is oven-cured.
- e. Color: Ensure that the exterior finish is as chosen from the manufacturer's standard color chart.
- f. **Coating Physical Properties:** Provide coating conforming to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:
  - (1) Chalking: **ASTM D4214**
  - (2) Coating Thickness: **ASTM B659**
  - (3) Color Change and Conformity: **ASTM D2244**
  - (4) Weatherometer: **ASTM G152, ASTM G153** and **ASTM D822**
  - (5) Humidity: **ASTM D2247** and **ASTM D714**
  - (6) Salt Spray: **ASTM B117**
  - (7) Chemical Pollution: **ASTM D1308**
  - (8) Gloss at 60: **ASTM D523**
  - (9) Pencil Hardness: **ASTM D3363**
  - (10) Reverse Impact: **ASTM D2794**
  - (11) Flexibility: **ASTM D522/D522M**
  - (12) Abrasion: **ASTM D968**
  - (13) Flame Spread: **ASTM E84**

## 2.5 ACCESSORIES

### 2.5.1 General

Provide only accessories which are compatible with the metal roof panels. Sheet metal flashing, trim, **metal closure strips**, caps and similar metal accessories can not be less than the minimum thickness specified for the roof panels. Submit a **10 inches** long sample of each type. Ensure the exposed metal accessories and finishes match the panels furnished, except as otherwise indicated. Provide molded-foam rib, ridge and other closure

strips which are non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match the configuration of the panels.

#### 2.5.2 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber conforming to [ASTM D1056](#) and [ASTM D1667](#); extruded or molded to the configuration of the specified roof panel and in lengths supplied by the roof-panel manufacturer.

#### 2.5.3 Metal Closure Strips

Provide factory fabricated [aluminum] [steel] closure strips of the same [gauge] [thickness], color, finish and profile as the specified roof panel.

#### 2.5.4 Joint Sealants

##### 2.5.4.1 Sealants

Provide an approved gun-type sealant for use in hand- or air-pressure caulking guns at temperatures above [40 degrees F](#) (or frostfree application at temperatures above [10 degrees F](#) with minimum solid content of 85 percent of the total volume. Provide sealant that has a tough, durable, dry surface skin that permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof-panel manufacturer.

- a. Shop-Applied Caulking: Use an approved gun-grade, non-sagging one-component polysulfide or silicone conforming to [ASTM C920, Type II](#), with a curing time to ensure the sealant's plasticity at the time of field erection.
- b. Field Applied Caulking: Use an approved gun-grade, non-sagging one-component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to [ASTM C920, Type II](#). Match the color to the panel colors.
- c. Tape Sealant: Use a pressure-sensitive, 100 percent solid with a release paper backing, permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof-panel manufacturer.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

The Contracting Officer may request verification and certification testing of [coatings and base metals of metal roofing](#) prior to installation. The following areas may be verified:

- a. Examine substrates, areas, and conditions, with the installer present, for compliance with the requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work.
- b. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required

by the metal roof-panel manufacturer, and as required for the geographical area where construction has taken place.

- c. Examine solid roof sheathing to verify that the sheathing joints are supported by framing or blocking and that the installation is within flatness tolerances required by the metal roof-panel manufacturer.
- d. Examine roughing-in for components and systems penetrating the metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- e. Submit to the Contracting Officer a written report, endorsed by the installer, listing conditions detrimental to performance of the work.
- f. Proceed with the installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

Clean substrates of substances harmful to insulation, remove projections capable of interfering with insulation attachment.

Install sub-purlins, eave angles, furring, and other miscellaneous roof-panel support members and anchorage according to the metal roof-panel manufacturer's written instructions.

### 3.3 INSTALLATION

#### 3.3.1 Workmanship

Ensure lines, arises, and angles are sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Ensure that sheet metal that is exposed to the weather is watertight, with provisions for expansion and contraction.

Ensure surfaces that are to receive sheet metal are plumb and true, clean, even, smooth, dry, and free of defects and projections that might affect the application. Install items not shown in detail or not covered by specifications conform to the applicable requirements of [SMACNA 1793](#). Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces, and wherever indicated and necessary to make the work watertight.

#### 3.3.2 Roof Panels

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the work in place, with provisions for thermal and structural movement in accordance with [NRCA 0429](#).

- [ a. Steel Roof Panels: Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.
- ] [ b. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for exterior surfaces and aluminum or galvanized steel fasteners for interior surfaces.



- ] [ c. Anchor Clips: Anchor metal roof panels and other components of the work securely in place. Use the manufacturer's approved fasteners according to the manufacturer's written instructions.
- ] d. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating conforming to [SSPC PS 9.01](#), by applying rubberized-asphalt underlayment to each contact surface, or with another means to separate the metals and contact surface as recommended by metal roof-panel manufacturer.
- e. Joint Sealers: Install gaskets, joint fillers, and sealants where required for weatherproof performance of metal roof panel assemblies. Provide the types of gaskets, fillers, and sealants indicated; or if not indicated, provide types recommended by the metal roof panel-manufacturer.

Erect the roofing system in accordance with the approved erection drawings, the printed instructions and the safety precautions of the manufacturer.

Do not overload, abuse, or subject sheets to undue impact. Do not apply bent, chipped, or defective sheets.

Erect sheets true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake, eave, and curb overhang.

Allow for thermal movement of the roofing and movement of the building structure, and provide permanent freedom from noise caused by wind pressure.

Field cutting metal roof panels by torch is not permitted.

Lay roofing sheets with corrugations in the direction of the roof slope. End laps of exterior roofing cannot be less than **8 inches**; the side laps of standard exterior corrugated sheets cannot be less than 2-1/2 corrugations.

Do not permit storage, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials and to distribute weight to conform to the indicated live-load limits of roof construction.

### 3.3.3 Fasteners

Anchor metal roof panels and other components of the work in place using the manufacturer's approved fasteners according to the manufacturer's written instructions.

### 3.3.4 Flashing, Trim and Closure

#### 3.3.4.1 General Requirements

Comply with performance requirements, the manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather-resistant.

Install sheet metalwork to form weathertight construction without waves,

warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Ensure sheet metal mechanics perform cutting, fitting, drilling, and other operations in connection with sheet metal work required to accommodate the work of other trades.

#### 3.3.4.2 Metal Flashing

Install metal flashing at building corners, rakes and eaves, junctions between metal siding and roofing, valleys and changes of slope or direction in metal roofing, and building expansion joints and gutters.

Provide exposed metal flashing that is the same material, color, and finish as the specified metal roofing.

Fasten flashing at not more than 8 inches on-center for roofs, except where flashing are held in place by the same screws that secure covering sheets.

Furnish flashing in at least 8 foot lengths. Provide exposed flashing that has 1 inch locked and blind-soldered end joints, and expansion joints at intervals of not more than 16 feet.

Bed exposed flashing and flashing subject to rain penetration in the specified joint sealant.

To prevent electrolytic deterioration, isolate flashing that is in contact with dissimilar metals by means of the specified asphalt-mastic material.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

#### 3.3.4.3 Closures

Install metal closure strips at the open ends of corrugated or ribbed pattern roofs, and at the intersection of wall and roof unless open ends are concealed with formed eave flashing, at the rake of the metal roof unless the open end has a formed flashing member, and in other required areas.

Install mastic closure strips at the intersection of the wall with metal roofing, at the top and bottom of metal siding, at the heads of wall openings, and in other required locations.

#### 3.3.5 Information Form and Placard

For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at the roof access point, or a photoengraved 0.032 inch thick aluminum card for exterior display. Format the card as directed in paragraph FORM ONE.

Provide an information card 8 1/2 inches by 11 inches minimum, identifying the facility name and number, location, contract number, approximate roof area, detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment, date of completion, installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install the card at [interior roof top access point] [\_\_\_\_\_] and provide a paper copy to the Contracting Officer.

### 3.4 FIELD QUALITY CONTROL

### 3.4.1 Acceptance Provisions

#### 3.4.1.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Do not vary horizontal lines more than  $1/8$  inch in 40 feet.

#### 3.4.1.2 Leakage Tests

Finished application of metal roofing is subject to inspection and test for leakage by the Contracting Officer, and architect/engineer. Conduct inspections and tests without cost to the Government.

Perform inspections and tests promptly after erection to permit correction of defects and the removal and replacement of defective materials.

#### 3.4.1.3 Repairs to Finish

Repair scratches, abrasions, and minor surface defects in the finish with the specified repair materials. Ensure repaired finished surfaces are uniform and free from variations of color and surface texture.

Immediately remove and replace repaired metal surfaces that are not acceptable to the project requirements with new material.

#### 3.4.1.4 Paint-Finish Metal Roofing

Test paint-finish metal roofing for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Remove and replace panels that have visual evidence of color changes, fading, or surface degradation, with new panels at no expense to the Government.

Replaced panels are subject to the specified tests for an additional year from the date of their installation.

### [3.4.2 Manufacturer's Inspection

Ensure the manufacturer's technical representative visits the site a minimum of [[three][\_\_\_\_\_] times ] [once per week] during the installation to review material installation practices and to verify the adequacy of work in place. [ Make inspections during the first 20 squares of roof panel installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections are required for each 100 squares of total roof area, with the exception that follow-up inspections of previously noted deficiencies or application errors are performed as requested by the Contracting Officer.] After each inspection, submit a report, signed by the manufacturer's technical representative, to the Contracting Officer within 3 working days. Note in the report the overall quality of work, deficiencies, and any other concerns, and recommended corrective action.

Submit three [\_\_\_\_\_] signed copies of the [manufacturer's field inspection reports](#) to the Contracting Officer within one week of substantial completion.

### ]3.4.3 Repair of Finish Protection

Provide repair paint for color-finish enameled roofing that is compatible with the paint of the same formula and color as the specified finish furnished by the roofing manufacturer.

## 3.5 ADJUSTING AND CLEANING

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings, and drilling debris and scrub the work clean. Ensure exposed metal surfaces are free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Dispose of demolished materials immediately. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

## 3.6 SCHEDULES

### 3.6.1 Form One



Facility Name and Number  
Approximate Roof Area Newly Installed and Date of Completion  
Manufacturer, Type of Roof Panel and Name  
Underlayment and Insulation System, R value  
Installing Contractor and Contact Information  
Warranty Expiration Date  
Warranty Reference Number and Contact Information

Install placard as directed by the Contracting Officer.

3.6.3 Warranty

CONTRACTOR'S [FIVE (5)] [TEN (10)] [TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM  
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY \_\_\_\_\_ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. FOR THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY INCLUDE, BUT DO NOT LIMIT TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHING INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

REPAIR ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY AS APPROVED BY THE CONTRACTING OFFICER. IN THIS WARRANTY COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON \_\_\_\_\_ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President) (Date)



CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOFING SYSTEM  
(continued)

ENSURE THE CONTRACTOR SUPPLEMENTS THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM. SUBMIT ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. IN CONTRACTOR'S DESIGN ENSURE FREE DRAINAGE FROM THE ROOF AND DO NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM  
(continued)

\*\*RESPOND TO REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. INITIATE EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS IMMEDIATELY; SUBMIT A WRITTEN PLAN FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. COMMENCE ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

UNDER THE CONTRACT DISPUTES ACT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. MAKE THE REQUEST FOR AN ARBITRATOR WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, WITHIN TEN (10) DAYS, ENSURE THE PARTIES JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR TO CONFER. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON IS THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., WILL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT PAYS FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. REQUEST A WRITTEN ARBITRATOR'S DECISION NO LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

POST A FRAMED COPY OF THIS WARRANTY IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

## SECTION 07 42 13

METAL WALL PANELS  
05/11, CHG 2: 02/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASD1 (2017; Errata 2017) Aluminum Standards and Data

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 501.1 (2017) Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
- AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 341 (2016) Seismic Provisions for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

- AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members
- AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

- ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN WELDING SOCIETY (AWS)

- AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
- AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel
- AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020)

## Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A424/A424M	(2009a; R 2016) Standard Specification for Steel Sheet for Porcelain Enameling
ASTM A463/A463M	(2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A606/A606M	(2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755/A755M	(2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C286	(2022) Standard Terminology Relating to

## Porcelain Enamel and Ceramic-Metal Systems

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D522/D522M	(2017) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D610	(2008; R 2019) Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D822	(2013; R 2018) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1654	(2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3359	(2017) Standard Test Methods for Rating Adhesion by Tape Test
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film

## Hardness by Pencil Test

ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D4587	(2011; R 2019; E 2019) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D5894	(2016) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM E72	(2015) Conducting Strength Tests of Panels for Building Construction
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM G152	(2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

## METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM	(2018) Metal Building Systems Manual
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## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual
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## PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001	(1996) Specification for Architectural
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Porcelain Enamel (ALS-100)

PEI CG-3

(2005) Color Guide for Architectural  
Porcelain Enamel

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA 1793

(2012) Architectural Sheet Metal Manual,  
7th Edition

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC

(2013) Leadership in Energy and  
Environmental Design(tm) New Construction  
Rating System

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir

(updated continuously online) Building  
Materials Directory

## 1.2 DEFINITIONS

Metal Wall Panel: Metal wall panels, attachment system components and accessories necessary for a complete weather-tight wall system.

## 1.3 DESCRIPTION OF WALL PANEL SYSTEM

[Factory color finished, ] [Mill finish ] [galvanized ] [galvalume ] [aluminum ] metal wall panel system with [ concealed fastening] [ exposed fastener] attachment. Panel profile must be [ embossed] [ recessed seam lock] [ flush face] [ smooth face] [ recessed bead] [ raised bead] [ striated] [ square ribbed] [ beaded rib] [ roll lock seam] [ snap lock seam] [ box rib] [ corrugated] [ standing seam] [ batten seam] [ and with stiffening ribs in the flat of the panel] [ as shown on drawings].

### 1.3.1 Metal Wall Panel General Performance

Comply with performance requirements, conforming to **AISI S100**, without failure due to defective manufacture, fabrication, installation, or other defects in construction. Wall panels and accessory components must conform to the following standards:

ASTM A1008/A1008M

ASTM A123/A123M

ASTM A36/A36M

[ ASTM A424/A424M, ASTM C286, PEI 1001, PEI CG-3 for Porcelain and Ceramic Enameling

] ASTM A653/A653M

[ ASTM A463/A463M for aluminum coated steel sheet

] ASTM A606/A606M

[ ASTM A755/A755M for metallic coated steel sheet for exterior coil pre-painted applications.

] [ASTM A780/A780M for repair of damage or uncoated areas of hot-dipped galvanized coating.

] [ASTM A924/A924M for metallic coated steel sheet

] ASTM D522/D522M for applied coatings

UL Bld Mat Dir

### 1.3.2 Structural Performance

Maximum calculated fiber stress must not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads is limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Contractor must provide design for members and connections not shown on the drawings. Siding panels and accessories must be the products of the same manufacturer.

Provide metal wall panel assemblies complying with the load and stress requirements in accordance with [ASTM E1592](#). Wind Load force due to wind action governs the design for panels.

Wall systems and attachments are to resist the wind loads as determined by [ASTM E72](#) and [ASCE 7-16](#) in the geographic area where the construction will take place, in pounds per square foot. Submit [five] [\_\_\_\_\_] copies of [wind load tests](#) and [seismic tests](#) to the Contracting Officer.

[ Provide metal wall panel assembly for seismic conditions complying with the applicable requirements of [AISC 341](#).  
]

### 1.3.3 Air Infiltration

Air leakage must conform to the limits through the wall assembly area when tested according to [ASTM E283](#).

### 1.3.4 Water Penetration Under Static Pressure

No water penetration when tested according to [ASTM E331](#).

### 1.3.5 Water Penetration Under Dynamic Pressure

No evidence of water leakage when tested according to [AAMA 501.1](#).

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section [01 33 00](#) SUBMITTAL PROCEDURES:

#### [SD-01 Preconstruction Submittals](#)

Submit Documentation for the following items:

[Qualification of Manufacturer; G\[, \[\\_\\_\\_\\_\]\]](#)  
[Qualification of Installation Contractor; G\[, \[\\_\\_\\_\\_\]\]](#)  
[\[Qualification of Welders; G\[, \[\\_\\_\\_\\_\]\]\]](#)  
[Sample Warranty; G\[, \[\\_\\_\\_\\_\]\]](#)

#### [SD-02 Shop Drawings](#)

[Installation Drawings ; G\[, \[\\_\\_\\_\\_\]\]](#)

#### [SD-03 Product Data](#)



**Recycled Content; (LEED NC)**

Submit Manufacturer's data indicating percentage of recycle material in wall panels to verify sustainable acquisition compliance.

Submit Manufacturer's catalog data for the following items:

Wall Panels ; G[, [\_\_\_\_\_]]

Factory Color Finish  
 Closure Materials  
 Pressure Sensitive Tape  
 Sealants and Caulking  
 Galvanizing Repair Paint  
 Enamel Repair Paint  
 Aluminized Steel Repair Paint  
 Accessories

**SD-04 Samples**

Submit as required each of the following samples:

Wall Panels, 12 inches long by actual panel width; G[, [\_\_\_\_\_]]

Fasteners; G[, [\_\_\_\_\_]]

Metal Closure Strips, 10 inches long of each type; G[, [\_\_\_\_\_]]

Color chart and chips ; G[, [\_\_\_\_\_]]

Submit manufacturer's color charts and chips, approximately 4 by 4 inches, showing full range of colors, textures and patterns available for wall panels with factory applied finishes.

**SD-05 Design Data**

Wind load design analysis ; G[, [\_\_\_\_\_]]

As applicable, submit the following wind load design analysis data, to include, but not limited to:

wind speed  
 exposure category,co-efficient,importance factor  
 type of facility  
 negative pressures for each zone  
 methods and requirements of attachment

**SD-06 Test Reports**

Submit test reports for the following in accordance with the referenced articles in this section.

Leakage Tests; G[, [\_\_\_\_\_]]

Wind Load Tests; G[, [\_\_\_\_\_]]

Coating Tests; G[, [\_\_\_\_\_]]

Chalking Tests; G[, [\_\_\_\_\_]]

[Seismic Tests; G[, [\_\_\_\_\_]]]

**SD-07 Certificates**

Submit certificates for the following items showing conformance with referenced standards contained in this section:

Coil Stock; G[, [\_\_\_\_]]  
 Fasteners; G[, [\_\_\_\_]]  
 Galvanizing Repair Paint; G[, [\_\_\_\_]]  
 Enamel Repair Paint; G[, [\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications.

Installation of Wall panels; G[, [\_\_\_\_]]

#### SD-09 Manufacturer's Field Reports

Submit [\_\_\_\_] bound copies of the **Manufacturer's Field Reports**; G[, [\_\_\_\_]]

#### SD-11 Closeout Submittals

Warranty; G[, [\_\_\_\_]]  
 Maintenance Instructions; G[, [\_\_\_\_]]

[ 20 year "No Dollar Limit" warranty for labor and material

### ]1.5 QUALITY ASSURANCE

#### 1.5.1 Pre-Installation Conference

Upon notification of submittal receipt and approval by the Contracting Officer; and prior to the commencement of the work, the Contractor must attend a pre-installation conference to review the following:

- a. Drawings and Specifications.
- b. Qualification of Installer[, Qualification of Welders].
- c. Sustainable acquisition
- d. Approved Warranty
- e. Sample wall panels, 12 inches long by actual panel width
- f. Sample metal closure strips, 10 inches long of each type
- g. Color charts and chips
- h. Coatings and base metal tests, chalking tests
- i. Construction schedule, availability of materials, Installer's personnel, equipment and facilities required to progress with the work without delay.
- j. Methods and procedures related to installation of wall panels, including manufacturer's written instructions. Explicitly identify in writing, differences between manufacturer's instructions and the

specified requirements.

- k. Support conditions for compliance with requirements, including alignment between and attachment to structural members.
- l. Flashing, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
- m. Governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
- n. Temporary protection requirements for metal wall panel assembly during and after installation.
- o. Wall panel observation and repair procedures after metal wall panel installation. Provide detailed written instructions including copies of Safety Data Sheets for maintenance and repair materials, and manufacturer's maintenance instructions.

#### 1.5.1.1 Installation Drawings

Installation shop drawings for wall panels, flashing, accessories, and anchorage systems must indicate completely dimensioned structural frame and erection layouts, openings in the wall, special framing details, and construction details at corners, building intersections and flashing, location and type of mastic and metal filler strips.

#### 1.5.1.2 Wind Load Design Analysis

Wind design analysis must include wall plan delineating dimensions and attachment patterns for each zone. Wind design analysis must be prepared and sealed by Licensed Project Engineer in the geographic area where the construction will take place.

#### 1.5.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and installations in the geographical area where construction will take place.

#### 1.5.3 Qualification of Manufacturer

Certify that metal wall panel system manufacturer has a minimum of five (5) years experience in manufacturing metal wall system and accessory products.

Manufacturer must also provide engineering services by an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four (4) years experience as an engineer knowledgeable in wind load design analysis, protocols and procedures per [MBMA MBSM](#), "Metal Building Systems Manual"; [ASCE 7-16](#), and [ASTM E1592](#) [ and seismic design conforming to [AISC 341](#)].

Provide certified engineering calculations, using the products submitted, for Wind load requirements in accordance with [ASCE 7-16](#).

##### 1.5.3.1 Manufacturer's Certificates

Also provide the following certifications from the manufacturer:

Coil Stock  
Fasteners  
Galvanizing Repair Paint  
Enamel Repair Paint

Submit certification from coil stock manufacturer or supplier that the machinery used will form the provided coil stock without warping, waviness, or rippling that is not a part of the panel profile, and without damage, abrasion or marring of the finish coating.

Provide evidence that products used within this specification are manufactured in the United States.

#### 1.5.4 Certified [Qualification of Installation Contractor](#)

The installation contractor must be approved and certified by the metal wall panel manufacturer prior to beginning the installation of the metal wall panel system. Subcontracting by Certified Contractor for the metal wall panel work is not permitted.

##### [1.5.4.1 Qualifications for Welding Work

[Qualification of welders](#) and welding must conform to [AWS A5.1/A5.1M](#), [AWS D1.1/D1.1M](#) for steel or [AWS D1.2/D1.2M](#) for aluminum.

##### ]1.5.5 Single Source

Obtain each type of metal wall panels, clips, [closure materials](#) and other [accessories](#) from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

##### 1.5.6

##### Manufacturer's [Maintenance Instructions](#)

Provide manufacturer's detailed written instructions including copies of Safety Data Sheets for maintenance and repair materials.

#### 1.6 DELIVERY, HANDLING, AND STORAGE

Deliver and protect package components, sheets, metal wall panels, and other manufactured items to prevent damage or deformation during transportation and handling.

Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack and store metal wall panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain strippable protective covering on metal wall panel until actual installation.

#### 1.7 PROJECT CONDITIONS

##### 1.7.1 Field Measurements

Verify locations of wall framing and opening dimensions by field

measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

#### 1.7.2 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into wall system or building.

#### 1.8 WARRANTY

Warranty must conform to the Sample Warranty as reviewed and approved by the Contracting Officer.

##### 1.8.1 20 Year "No Dollar Limit" Warranty for Labor and Material

Furnish manufacturer's no-dollar-limit warranty for the metal wall panel system. The warranty period is to be no less than twenty (20) years from the date of Government acceptance of the work. The warranty is to be issued directly to the Government. The warranty is to provide that if within the warranty period the metal wall panel system shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the wall panel system resulting from defective materials and correction of the defective workmanship is to be the responsibility of the metal wall panel system manufacturer. Repairs that become necessary because of defective materials and workmanship while metal wall panel system is under warranty are to be performed within 24 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within 24 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty.

## PART 2 PRODUCTS

### 2.1 FABRICATION

Unless approved otherwise, fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated and specified performance requirements. Comply with indicated profiles and with dimensional and structural requirements. See section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total recycled content requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Fabricate metal wall panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

#### 2.1.1 Sheet Metal Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 that apply to the design, dimensions, metal, and other characteristics of item indicated:

- a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

- b. End Seams: fabricate nonmoving end seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- c. Sealed Joints: form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with [SMACNA 1793](#).
- d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- e. Fabricate cleats and attachment devices of size and metal thickness recommended by [SMACNA 1793](#) or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

## 2.2 PANEL MATERIALS

### [2.2.1 Aluminum Sheet

Roll-form aluminum [wall panels](#) to the specified profile, with  $f_y =$  [\[30\]\[40\]\[50\]\[80\]](#) ksi, [\[.032\]\[.040\]\[.050\]](#) inches thickness and depth as indicated. Material must be plumb and true, and within the tolerances listed:

- a. Aluminum Sheet conforming to [ASTM B209](#), [AA ASD1](#) and [AA ADM](#).
  - b. Individual panels must have continuous length to cover the entire length of any wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
  - c. Provide panels with thermal expansion and contraction consistent with the type of system specified.
- [ 1. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated wall area.
  - ][ 2. Profile to be a [1-1/2 inch](#) high rib at [12 inches](#) o.c. with small stiffening ribs, [38 inch](#) overall width with [36 inch](#) coverage and exposed fasteners.
  - ][ 3. Profile to be a [1-1/2 inch](#) high rib at [7.2 inches](#) o.c., [38-7/8 inch](#) overall width with [36 inch](#) coverage and exposed fasteners.
  - ][ 4. Profile to be a [1 inch](#) high rib at [4 inches](#) o.c., [49-5/8 inch](#) overall width with [\[48\]\[44\]](#) inch coverage and exposed fasteners.
  - ][ 5. Profile to be a [1 inch](#) high rib at [8 inches](#) o.c., [41-5/8 inch](#) overall width with [40 inch](#) coverage and exposed fasteners.
  - ][ 6. Profile to be a [1-3/4 inch](#) high V-beam rib at [5 inches](#) o.c., [44-7/8 inch](#) overall width with [42 inch](#) coverage and exposed fasteners.
  - ][ 7. Profile to be a [7/8 inch](#) high corrugated rib at [2 inches](#) o.c., [38-7/8 inch](#) overall width with [36 inch](#) coverage and exposed fasteners.
  - ][ 8. Profile to be a [3 inch](#) high standing seam, [24 inch](#) coverage,

factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 9. Profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 10. [Smooth, flat ] [Embossed ] surface texture.

]] [2.2.2 Steel Sheet

Roll-form steel wall panels to the specified profile, with  $f_y$ = [30] [40] [50] [80] ksi, [26] [24] [22] [20] [18] gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

[ a. Galvanized Steel Sheet conforming to ASTM A653/A653M and AISI SG03-3.

] [b. Aluminum-Zinc Alloy-coated Steel Sheet conforming to ASTM A792/A792M and AISI SG03-3.

] c. Individual panels must be continuous length to cover the entire length of any unbroken wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.

d. Provide panels with thermal expansion and contraction consistent with the type of system specified.

[ 1. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated wall area.

] [ 2. Profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.

] [ 3. Profile to be a 1-1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.

] [ 4. Profile to be a 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.

] [ 5. Profile to be a 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.

] [ 6. Profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.

] [ 7. Profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 8. Profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 9. [Smooth, flat] [Embossed] Surface Texture.

]]2.2.3 **Factory Color Finish**

Comply with **NAAMM AMP 500** for recommendations for applying and designating finishes. Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

All panels are to receive a factory-applied [polyvinylidene fluoride] [Kynar 500/Hylar 5000] [\_\_\_\_\_] finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

2.2.3.1 **Metal Preparation**

Carefully prepare all metal surface for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.

2.2.3.2 **Prime Coating**

Apply a base coat of epoxy paint, specifically formulated to interact with the top-coat, to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. Prime coat must be oven cured prior to application of finish coat.

2.2.3.3 **Exterior Finish Coating**

Roll coat the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 5 mils (3.80 plus 0.50 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol). Oven-cure finish coat.

2.2.3.4 **Interior Finish Coating**

Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. Oven-cured the wash coat.

2.2.3.5 **Color**

Provide exterior finish color as [selected by the Contracting Officer from the manufacturer's standard **color chart**] [as specified].

2.2.3.6 **Physical Properties**

**Coating** must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General:	ASTM D5894 and ASTM D4587
Abrasion:	ASTM D968
Adhesion:	ASTM D3359
Chalking:	ASTM D4214



Chemical Pollution:	ASTM D1308
Color Change and Conformity:	ASTM D2244
Creepage:	ASTM D1654
Cyclic Corrosion Test:	ASTM D5894
Flame Spread:	ASTM E84
Flexibility:	ASTM D522/D522M
Formability:	ASTM D522/D522M
Gloss at 60 and 85 degrees:	ASTM D523
Humidity:	ASTM D2247 and ASTM D714
Oxidation:	ASTM D610
Pencil Hardness:	ASTM D3363
Reverse Impact:	ASTM D2794
Salt Spray:	ASTM B117
Weatherometer:	ASTM G152, ASTM G153 and ASTM D822

### 2.3 MISCELLANEOUS METAL FRAMING

Cold-formed metallic-coated steel sheet conforming to ASTM A653/A653M and specified in Section 05 40 00 COLD-FORMED METAL FRAMING unless otherwise indicated.

#### 2.3.1 Fasteners for Miscellaneous Metal Framing

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to supporting members and substrates in accordance with the wall panel manufacturer's and ASCE 7-16 requirements.

### 2.4 FASTENERS

#### 2.4.1 General

##### 2.4.1.1 Exposed Fasteners

Provide corrosion resistant fasteners for wall panels, made of coated steel, aluminum, [300 - series corrosion resisting stainless steel] [305 - series corrosion resisting stainless steel], or nylon capped steel compatible with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads.

Fasteners for accessories must be the manufacturer's standard. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick.

#### 2.4.1.2 Hidden Fasteners

Provide corrosion resistant fasteners recommended by the manufacturer to meet the performance requirements and design loads.

#### 2.4.1.3 Screws

Screws to be corrosion resistant coated steel, aluminum and/or [300 - series] [305 - series] stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

#### 2.4.1.4 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

#### 2.4.1.5 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with [ASTM A653/A653M](#), Z275 G 90 or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

### 2.5 ACCESSORIES

#### 2.5.1 General

All accessories must be compatible with the metal wall panels. Sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the wall panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips must be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

#### 2.5.2 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber conforming to [ASTM D1056](#) and [ASTM D1667](#); extruded or molded to the configuration of the specified wall panel and in lengths supplied by the wall panel manufacturer.

#### 2.5.3 Metal Closure Strips

Provide factory fabricated [aluminum] [steel] closure strips to be the same [gauge] [thickness], color, finish and profile of the specified wall panel.

#### 2.5.4 Joint Sealants

##### 2.5.4.1 Sealants and Caulking

Provide approved gun type sealants for use in hand- or air-pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F with minimum solid content of 85 percent of the total volume. Sealants must dry with a tough, durable surface skin

which permit remaining soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints receiving sealants with a compatible one-component or two-component primer as recommended by the wall panel manufacturer.

#### 2.5.4.2 Shop-Applied

Sealant for shop-applied caulking must be non-curing butyl compliant with [AAMA 800](#) to ensure the sealant's plasticity at the time of field erection.

#### 2.5.4.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to [ASTM C920](#), Type II. Color to match panel colors.

#### 2.5.4.4 Pressure Sensitive Tape

Provide pressure sensitive tape sealant, 100 percent solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the wall panel manufacturer.

### 2.6 SHEET METAL FLASHING AND TRIM

#### 2.6.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in [SMACNA 1793](#) that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

### 2.7 REPAIR OF FINISH PROTECTION

Repair paint for color finish enameled wall panel must be compatible paint of the same formula and color as the specified finish furnished by the wall panel manufacturer. Provide [\_\_\_\_\_] [ pints] [ quarts] of [[aluminized steel repair paint](#)] [repair paint matching the specified wall panels].

## PART 3 EXECUTION

### 3.1 EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.

Examine primary and secondary wall framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer, UL, ASTM, [ASCE 7-16](#) and as required for the geographical area where construction will take place.

Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment. Miscellaneous framing installation, including sub-purlins, girts, angles, furring, and other miscellaneous wall panel support members and anchorage must be according to metal wall panel manufacturer's written instructions.

### 3.3 WALL PANEL [INSTALLATION](#)

Provide full length metal wall panels, from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement in accordance with [MBMA](#) [MBSM](#).

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

#### [3.3.1 Steel Wall Panels

Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.

#### ] [3.3.2 Aluminum Wall Panels

Use aluminum or stainless-steel fasteners for exterior surfaces and aluminum or galvanized steel fasteners for interior surfaces.

#### ] [3.3.3 Anchor Clips

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

### ]3.3.4 Metal Protection

Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

### 3.3.5 Joint Sealers

Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

## 3.4 FASTENER INSTALLATION

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

## 3.5 FLASHING, TRIM AND CLOSURE INSTALLATION

### 3.5.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams to form permanently watertight and weather resistant.

Install sheet metal work is to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

### 3.5.2 Metal Flashing

Install exposed metal flashing at building corners, sills and eaves, junctions between metal siding and walling. Exposed metal flashing must be the same material, color, and finish as the specified metal wall panel.

Fasten flashing at a minimum of [8 inches](#) on center, except where flashing is held in place by the same screws that secure covering sheets.

Flashing is to be furnished in at least [8 foot](#) lengths. Exposed flashing is to have [1 inch](#) locked and blind-soldered end joints, and expansion joints at intervals of not more than [16 feet](#).

Exposed flashing and flashing subject to rain penetration to be bedded in the specified joint sealant.

Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back [1/2 inch](#) to form a reinforced drip edge.

### 3.5.3 Closures

Install metal closure strips at open ends of corrugated or ribbed pattern walls, and at intersection of wall and wall unless open ends are concealed with formed eave flashing; and in other required areas.

Install mastic closure strips at intersection of the wall with metal walling; top and bottom of metal siding; heads of wall openings; and in other required locations.

### 3.6 WORKMANSHIP

Make lines, arises, and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of [SMACNA 1793](#). Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

### 3.7 ACCEPTANCE PROVISIONS

#### 3.7.1 Erection Tolerances

Erect metal wall panels straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions.

#### 3.7.2 Leakage Tests

Finished application of metal wall panels are to be subject to inspection and test for leakage by request of the Contracting Officer, Architect/Engineer. Conduct inspection and tests at no cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and the removal and replacement of defective materials.

#### 3.7.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials. Finished repaired surfaces must be uniform and free from variations of color and surface texture.

Repaired metal surfaces that are not acceptable to the project requirements and/or Contracting Officer are to be immediately removed and replaced with new material.

#### 3.7.4 Paint-Finish Metal Siding

Paint-finish metal siding will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Panels that indicate color changes, fading, or surface degradation,

determined by visual examination, must be removed and replaced with new panels at no expense to the Government.

New panels will be subject to the specified tests for an additional year from the date of their installation.

### 3.8 FIELD QUALITY CONTROL

#### 3.8.1 Construction Monitoring

Make visual inspections as necessary to ensure compliance with specified requirements. Additionally, verify the following:

- a. Materials comply with the specified requirements.
- b. All materials are properly stored, handled and protected from damage. Damaged materials are removed from the site.
- c. Framing and substrates are in acceptable condition, in compliance with specification, prior to application of wall panels.
- d. Panels are installed without buckles, ripples, or waves and in uniform alignment and modulus.
- e. Side laps are formed, sealed, fastened or seam locked as required.
- f. The proper number, type, and spacing of attachment clips and fasteners are installed.
- g. Installer adheres to specified and detailed application parameters.
- h. Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Provide [five] [\_\_\_\_\_] bound copies of [Manufacturer's Field Reports](#) to the Contracting Officer [two] [\_\_\_\_\_] weeks prior to project close-out.

### 3.9 CLEAN-UP AND DISPOSAL

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

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## SECTION 07 42 63

## FABRICATED WALL PANEL ASSEMBLIES

05/11, CHG 4: 08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASD1 (2017; Errata 2017) Aluminum Standards and Data

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 501.1 (2017) Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 341 (2016) Seismic Provisions for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

- AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members
- AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

- ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN WELDING SOCIETY (AWS)

- AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
- AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel
- AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A424/A424M	(2009a; R 2016) Standard Specification for Steel Sheet for Porcelain Enameling
ASTM A463/A463M	(2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A606/A606M	(2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755/A755M	(2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C273/C273M	(2020) Standard Test Method for Shear Properties of Sandwich Core Materials
ASTM C286	(2022) Standard Terminology Relating to

## Porcelain Enamel and Ceramic-Metal Systems

ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D522/D522M	(2017) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D822	(2013; R 2018) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D1622/D1622M	(2014) Apparent Density of Rigid Cellular Plastics
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the

	Effects of Rapid Deformation (Impact)
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D6226	(2015) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM G152	(2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

## METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM	(2018) Metal Building Systems Manual
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## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual
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## PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001 (1996) Specification for Architectural Porcelain Enamel (ALS-100)

PEI CG-3 (2005) Color Guide for Architectural Porcelain Enamel

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793 (2012) Architectural Sheet Metal Manual, 7th Edition

UL ENVIRONMENT (ULE)

ULE Greenguard UL Greenguard Certification Program

UNDERWRITERS LABORATORIES (UL)

UL 580 (2006; Reprint Mar 2019) UL Standard for Safety Tests for Uplift Resistance of Roof Assemblies

UL Bld Mat Dir (updated continuously online) Building Materials Directory

## 1.2 DEFINITIONS

Fabricated Wall Panel Assembly: Metal wall and liner panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories shop fabricated or field assembled for a complete weather-tight wall system.

## 1.3 DESCRIPTION OF FABRICATED WALL PANEL ASSEMBLY SYSTEM

[Factory color finished,] [Mill finish] [galvanized] [galvalume] [aluminum] metal wall panel system with [concealed fastening] [exposed fastener] attachment. Panel profile must be [embossed] [recessed seam lock] [flush face] [smooth face] [recessed bead] [raised bead] [striated] [square ribbed] [beaded rib] [roll lock seam] [snap lock seam] [box rib] [corrugated] [standing seam] [batten seam] [ and with stiffening ribs in the flat of the panel] [as shown on drawings]. Interior finish of panel assembly to be [\_\_\_\_\_].

### 1.3.1 Metal Wall Panel General Performance

Comply with performance requirements, conforming to AISI S100, without failure due to defective manufacture, fabrication, installation, or other defects in construction. Wall panels and accessory components must conform to the following standards:

ASTM A1008/A1008M

ASTM A123/A123M

ASTM A36/A36M

[ ASTM A424/A424M, ASTM C286, PEI 1001, PEI CG-3 for Porcelain and

Ceramic Enameling  
 ] [ASTM A653/A653M](#)  
 [ [ASTM A463/A463M](#) for aluminum coated steel sheet  
 ] [ASTM A606/A606M](#)  
 [ [ASTM A755/A755M](#) for metallic coated steel sheet for exterior coil  
 pre-painted applications.  
 ] [ [ASTM A780/A780M](#) for repair of damage or uncoated areas of hot-dipped  
 galvanized coating.  
 ] [ [ASTM A924/A924M](#) for metallic coated steel sheet  
 ] [ASTM C273/C273M](#)  
[ASTM D522/D522M](#) for applied coatings  
[UL Bld Mat Dir](#)

### 1.3.2 Structural Performance

Maximum calculated fiber stress must not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads is limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Contractor must provide design for members and connections not shown on the drawings. Siding panels and accessories must be the products of the same manufacturer.

Provide metal wall panel assemblies complying with the load and stress requirements in accordance with [ASTM E1592](#). Wind Load force due to wind action governs the design for panels.

Wall systems and attachments are to resist the wind loads as determined by [UL 580](#) and [ASCE 7-16](#) in the geographic area where the construction will take place, in pounds per square foot. Submit [five] [\_\_\_\_\_] copies of [wind load tests](#) and [seismic tests](#) to the Contracting Officer.

[ Provide metal wall panel assembly for seismic conditions complying with the applicable requirements of [AISC 341](#).

### ]1.3.3 Air Infiltration

Air leakage must conform to the limits through the wall assembly area when tested according to [ASTM E283](#).

### 1.3.4 Water Penetration Under Static Pressure

No water penetration when tested according to [ASTM E331](#).

### 1.3.5 Water Penetration Under Dynamic Pressure

No evidence of water leakage when tested according to [AAMA 501.1](#).

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

[SD-01 Preconstruction Submittals](#)

Qualification of Manufacturer

Qualification of Installer

Qualifications for Welding Work

#### SD-02 Shop Drawings

Fabrication and Installation drawings for the following items are to indicate completely dimensioned structural frame and erection layouts, openings in the wall, special framing details, and construction details at corners, building intersections and flashing, location and type of mastic and metal filler strips.

Wall Panel Assemblies

Flashing and Accessories

Anchorage Systems

#### SD-03 Product Data

Certification

Submit Manufacturer's data indicating percentage of recycle material in wall panels to verify sustainable acquisition compliance.

Submit Manufacturer's catalog data for the following items:

Factory Color Finish

Sub-girts and Formed Shapes

Closure Materials

Insulation

Pressure Sensitive Tape

Sealants and Caulking

Rated Wall Assembly

Galvanizing Repair Paint

Enamel Repair Paint

Aluminized Steel Repair Paint

Accessories

#### SD-04 Samples

Submit as required each of the following samples:

Wall Panel Assemblies, 12 inches long by actual panel width

### Fasteners

Metal Closure Strips, 10 inches long of each type

Insulation, approximately 8 by 11 inches

Submit manufacturer's color charts and chips, approximately 4 by 4 inches, showing full range of colors, textures and patterns available for wall panels with factory applied finishes.

### SD-05 Design Data

Wind Design Analysis

### SD-06 Test Reports

Submit test reports for the following in accordance with the referenced articles in this section.

Leakage Tests

Wind Load Tests

Seismic Tests

Coatings and base metals of metal wall type of test as specified in paragraphs STEEL SHEET MATERIALS and in various referenced standards in this section.

Factory Color Finish Performance Requirements

### SD-07 Certificates

Submit certificates for the following items showing conformance with referenced standards contained in this section:

Fasteners

Galvanizing Repair Paint

Enamel Repair Paint

Provide evidence that products used within this specification are manufactured in the United States.

Submit the wall system assembly wind load and fire rating classification listings.

### SD-08 Manufacturer's Instructions

Installation of Wall Panels

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

### SD-11 Closeout Submittals



## Warranty

### Instructions To:

Government and/or Contractor Personnel

### Safety Data Sheets

Submit 20 year "No-Dollar-Limit" Warranty for labor and materials.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Pre-Installation Conference

After submittals are received and approved but before wall panel and insulation work, including associated work, is performed, the Contracting Officer will hold a pre-siding conference to review the following:

- a. The drawings, including [Fabrication and Installation drawings](#), showing complete [Wall Panel Assemblies](#), and specifications. Include details for the following for review:

- [flashing and accessories](#)
- [anchorage systems](#)
- [manufacturer's catalog data](#)
- [Factory Color Finish](#)

Submit [manufacturer's color charts and chips](#), approximately 4 by 4 inches, showing full range of colors, textures and patterns available for wall panels with factory applied finishes.

- [Sub-girts and Formed Shapes](#)
- [Closure Materials](#), including [metal closure strips](#).
- [Insulation](#)
- [Pressure Sensitive Tape](#)
- [Rated Wall Assembly](#) test data
- [Accessories](#)
- [Fasteners](#)

- b. Finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- c. Methods and procedures related to metal wall panel installation, including manufacturer's written [instructions](#) for [Installation of Wall panels](#), and verification of [wall system assembly wind load and fire rating classification listings](#).
- d. Support conditions for compliance with requirements, including alignment between and attachment to structural members. Provide details of [wind design analysis](#) including wind speed, exposure category, co-efficient, importance factor, designates type of facility, negative pressures for each zone, methods and requirements of attachment. Wind design analysis to include wall plan delineating dimensions and attachment patterns for each zone. Wind design analysis to be prepared and sealed by Licensed Project Engineer in the geographic area where the construction will take place.
- e. Flashing, special siding details, wall penetrations, openings, and

condition of other construction that will affect metal wall panels.

- f. Governing regulations and requirements for insurance, certificates, tests and inspections if applicable. Include certification for [sustainable acquisition](#) and wall system assembly wind load and fire rating classification. Safety plan review must include applicable [Safety Data Sheets](#) for maintenance/repair materials.
- g. Temporary protection requirements for metal wall panel assembly during and after installation.
- h. Wall panel observation and repair procedures after metal wall panel installation. Include review of sample [[Galvanizing Repair Paint](#)] [[Enamel Repair Paint](#)] [[Aluminized Steel Repair Paint](#)].
- i. Sample [[20 year "No-Dollar-Limit" warranty](#)] [[Warranty](#)].

#### 1.5.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and installations in the geographical area where construction will take place.

#### 1.5.3 [Qualification of Manufacturer](#)

Metal wall panel system manufacturer must have:

- a. A minimum of five (5) years experience in manufacturing metal wall system and accessory products.
- b. Provide engineering services by an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four (4) years experience as an engineer knowledgeable in wind load design analysis, protocols and procedures for the [MBMA MBSM](#); [ASCE 7-16](#), and [ASTM E1592](#).
- c. Provide certified engineering calculations using the products submitted for:

Wind load requirements in accordance with FM Wind Design Guide and [ASCE 7-16](#).

#### 1.5.4 [Qualification of Installer](#)

The installation contractor must be approved and certified by the wall panel manufacturer prior to beginning the installation of the metal wall system.

##### 1.5.4.1 [Qualifications for Welding Work](#)

Welding procedures must conform to [AWS A5.1/A5.1M](#), [AWS D1.1/D1.1M](#) for steel or [AWS D1.2/D1.2M](#) for aluminum.

#### 1.5.5 Single Source

Obtain each type of metal wall and liner panels, clips, closures and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

### 1.5.6 Surface-Burning Characteristics

Provide metal wall panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to [ASTM E84](#) by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: [25] [\_\_\_\_\_] or less.
- b. Smoke-Developed Index: [450] [\_\_\_\_\_] or less.

### 1.5.7 Fire-Resistance Ratings

Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per [ASTM E119](#) by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.  
Combustion Characteristics: [ASTM E136](#).

### 1.5.8 Fabrication

Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Fabricate metal wall panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

#### 1.5.8.1 Sheet Metal Accessories

Fabricate flashing and trim to comply with recommendations in [SMACNA 1793](#) that apply to the design, dimensions, metal, and other characteristics of item indicated:

- a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- c. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA or by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

### 1.5.9 Finishes

Comply with **NAAMM AMP 500** for recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

#### [1.5.10 Sustainable Design Certification

Product shall be third party certified in accordance with **ULE Greenguard[ Gold]**, **SCS Scientific Certification Systems Indoor Advantage[ Gold ]** or equal. Certification shall be performed annually and shall be current.

### ]1.6 DELIVERY, HANDLING, AND STORAGE

Deliver and package components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed and protected during transportation and handling.

Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack and store metal wall panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

Protect foam-plastic insulation as follows:

- a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
- b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### 1.7 PROJECT CONDITIONS

Weather Limitations: Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing walling system or building.

Field Measurements: Verify locations of wall framing and opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

### 1.8 WARRANTY

Furnish manufacturer's no-dollar-limit warranty for the metal wall panel

system. The warranty period is to be no less than twenty (20) years from the date of Government acceptance of the work. The warranty is to be issued directly to the Government. The warranty is to provide that if within the warranty period the metal wall panel system shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the wall panel system resulting from defective materials and correction of the defective workmanship is to be the responsibility of the metal wall panel system manufacturer. Repairs that become necessary because of defective materials and workmanship while metal wall panel system is under warranty are to be performed within 24 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within 24 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty.

## PART 2 PRODUCTS

### 2.1 PANEL MATERIALS

#### [2.1.1 Aluminum Sheet

Roll-form aluminum wall and liner panels to the specified profile, with  $f_y$  = , [.032 ] [.040 ] [.050 ] thickness and depth as indicated. Material must be plumb and true, and within the tolerances listed:

- a. Aluminum Sheet conforming to [ASTM B209](#), [AA ASD1](#) and [AA ADM](#).
  - b. Individual panels to have continuous length to cover the entire length of any wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
  - c. Provide panels with thermal expansion and contraction consistent with the type of system specified.
- [ 1. Profile and coverage to be a minimum height and width from manufacturer s standard for the indicated wall area.
  - ] [ 2. Profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.
  - ] [ 3. Profile to be a 1-1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
  - ] [ 4. Profile to be a 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.
  - ] [ 5. Profile to be a 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.
  - ] [ 6. Profile to be a 1-3/4 inch high V-beam rib at 5 inches o.c., 44-7/8 inch overall width with 42 inch coverage and exposed fasteners.
  - ] [ 7. Profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
  - ] [ 8. Profile to be a 3 inch high standing seam, 24 inch coverage,

factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 9. Profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.

] 10. [Smooth, flat ] [Embossed ] surface texture.

] [2.1.2 Steel Sheet

Roll-form steel wall and liner panels to the specified profile, with  $f_y =$  [26] [24] [22] [20] [18] gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

[ a. Galvanized Steel Sheet conforming to ASTM A653/A653M and AISI SG03-3.

] [b. Aluminum-Zinc Alloy-coated Steel Sheet conforming to ASTM A792/A792M and AISI SG03-3.

] c. Individual panels to have continuous length to cover the entire length of any unbroken wall area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.

e. Provide panels with thermal expansion and contraction consistent with the type of system specified.

[ 1. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated wall area.

] [ 2. Profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.

] [ 3. Profile to be a 1-1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.

] [ 4. Profile to be a 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.

] [ 5. Profile to be a 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.

] [ 6. Profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.

] [ 7. Profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 8. Profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.

] 9. [Smooth, flat ] [Embossed ] surface texture.

] [2.1.3 Foam-Insulation Core Wall Panel

Provide factory-formed[ aluminum][ steel] wall panel assembly fabricated from two sheets of metal with modified polyisocyanurate or polyurethane foam insulation core[ foamed-in-place][ board] during fabrication with joints between panels designed to form weather-tight seals. Include accessories required for weather-tight installation.

- a. Closed-Cell Content: 90 percent when tested according to [ASTM D6226](#).
- b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to [ASTM D1622/D1622M](#).
- c. Compressive Strength: Minimum 20 psi when tested according to [ASTM D1621](#).
- d. Shear Strength: 26 psi when tested according to [ASTM C273/C273M](#).

#### ]2.1.4 Insulated Panel Construction

Shop fabricate or field assemble insulated panel construction with specified exterior and interior[ aluminum][ steel] sheet in accordance with manufacturer's printed instructions.

Insulation to be[ glass-fiber][ slag-wool-fiber][ rock-wool-fiber] conforming to [ASTM C553](#) and [ASTM C612](#) of thickness and density as required for the geographical area where construction will take place. Glass-Fiber and Mineral-Wool-Fiber are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>).

Insulation fasteners to be adhesively attached, plate welded to projecting spindle anchors; capable of holding insulation of thickness indicated, secured in position with self-locking washer and complying with the following requirements:

- a. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
- b. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- c. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
- d. Anchor adhesive to be a product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

#### 2.1.5 Finish

All panels are to receive a factory-applied[ polyvinylidene fluoride][ Kynar 500/Hylar 5000] [\_\_\_\_\_] finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough

drying.

- b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. This prime coat must be oven cured prior to application of finish coat.
- c. Exterior Finish Coating: Apply the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 5 mils (3.80 plus 0.50 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol). This finish coat must be oven-cured.
- d. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. The wash-coat must be oven-cured.
- e. Color: The exterior finish chosen from the manufacturer's standard color chart.
- f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

Chalking:	ASTM D4214
Color Change and Conformity:	ASTM D2244
Weatherometer:	ASTM G152, ASTM G153 and ASTM D822
Humidity:	ASTM D2247 and ASTM D714
Salt Spray:	ASTM B117
Chemical Pollution:	ASTM D1308
Gloss at 60:	ASTM D523
Pencil Hardness:	ASTM D3363
Reverse Impact:	ASTM D2794
Flexibility:	ASTM D522/D522M
Abrasion:	ASTM D968
Flame Spread:	ASTM E84

## 2.2 MISCELLANEOUS METAL FRAMING

### 2.2.1 General

Cold-formed metallic-coated steel sheet conforming to ASTM A653/A653M and



specified in Division 05 Section 05 40 00 "Cold-Formed Metal Framing" unless otherwise indicated.

## 2.3 FASTENERS

### 2.3.1 General

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the wall panel manufacturer's and ASCE 7-16 requirements.

### 2.3.2 Exposed Fasteners

Fasteners for wall panels to be corrosion resistant coated steel, aluminum, stainless steel, or nylon capped steel compatible with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories to be the manufacturer's standard. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inches thick.

### 2.3.3 Screws

Screws to be corrosion resistant coated steel, aluminum and/or stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

### 2.3.4 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

### 2.3.5 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A653/A653M, or Series [300][305] stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

## 2.4 ACCESSORIES

### 2.4.1 General

All accessories to be compatible with the metal wall panels. Sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the wall panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips to be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

### 2.4.2 Rubber Closure Strips

Closed-cell, expanded cellular rubber conforming to ASTM D1056 and ASTM D1667; extruded or molded to the configuration of the specified wall panel and in lengths supplied by the wall panel manufacturer.

### 2.4.3 Metal Closure Strips

Factory fabricated[ aluminum][ steel] closure strips to be the same[ gauge][ thickness], color, finish and profile of the specified wall panel.

#### 2.4.4 Joint Sealants

##### 2.4.4.1 Sealants and Caulking

Sealants are to be an approved gun type for use in hand- or air-pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F) with minimum solid content of 85 percent of the total volume. Sealant is to dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the wall panel manufacturer.

##### 2.4.4.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C920, Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

##### 2.4.4.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to ASTM C920, Type II. Color to match panel colors.

##### 2.4.4.4 Tape Sealant

Pressure sensitive, 100 percent solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the wall panel manufacturer.

#### 2.5 SHEET METAL FLASHING AND TRIM

##### 2.5.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in SMACNA 1793 that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

#### 2.6 REPAIR OF FINISH PROTECTION

Repair paint for color finish enameled wall panel must be compatible paint of the same formula and color as the specified finish furnished by the wall panel manufacturer.

#### PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.
- B. Examine primary and secondary wall framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer, UL, ASTM, [ASCE 7-16](#) and as required for the geographical area where construction will take place.
- C. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
- D. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- E. Submit to the Contracting Officer a written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Miscellaneous Framing: Install sub-purlins, girts, angles, furring, and other miscellaneous wall panel support members and anchorage according to metal wall panel manufacturer's written instructions.

### 3.3 WALL PANEL INSTALLATION

Provide metal wall panels of full length from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement in accordance with MBMA Metal Building Systems Manual.

- [ a. Steel Wall Panels: Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.
- ] [b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for exterior surfaces and aluminum or galvanized steel fasteners for interior surfaces.
- ] [c. Anchor Clips: Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturer's written instructions.
- ] d. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other

permanent separation as recommended by metal wall panel manufacturer.

- e. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

### 3.4 FASTENER INSTALLATION

Anchor metal wall panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturer's written instructions.

### 3.5 FLASHING, TRIM AND CLOSURE INSTALLATION

#### 3.5.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

Sheet metalwork is to be accomplished to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

#### 3.5.2 Metal Flashing

Exposed metal flashing is to be installed at building corners, sills and eaves, junctions between metal siding and walling.

Exposed metal flashing is to be the same material, color, and finish as the specified metal wall panel.

Flashing is to be fastened at not more than [8 inches](#) on center, except where flashing are held in place by the same screws that secure covering sheets.

Flashing is to be furnished in at least [8 foot](#) lengths. Exposed flashing is to have [1 inch](#) locked and blind-soldered end joints, and expansion

joints at intervals of not more than 16 feet.

Exposed flashing and flashing subject to rain penetration to be bedded in the specified joint sealant.

Flashing which is in contact with dissimilar metals to be isolated by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Drips to be formed to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

### 3.5.3 Closures

Install metal closure strips at open ends of corrugated or ribbed pattern walls, and at intersection of wall and wall unless open ends are concealed with formed eave flashing; and in other required areas.

Install mastic closure strips at intersection of the wall with metal walling; top and bottom of metal siding; heads of wall openings; and in other required locations.

### 3.6 WORKMANSHIP

Make lines, arises, and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

### 3.7 ACCEPTANCE PROVISIONS

#### 3.7.1 Erection Tolerances

Erect metal wall panels straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines must not vary more than 1/8 inch in 40 feet.

#### 3.7.2 Leakage Tests

Inspect and test finished application of metal wall panels when directed to do so by the Contracting Officer. Inspection and tests must be conducted without cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and the removal and replacement of defective materials.

#### 3.7.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials. Finished repaired surfaces must be

uniform and free from variations of color and surface texture.

Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

#### 3.7.4 Paint-Finish Metal Siding

Paint-finish metal siding will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Panels that indicate color changes, fading, or surface degradation, determined by visual examination, must be removed and replaced with new panels at no expense to the Government.

New panels will be subject to the specified tests for an additional year from the date of their installation.

#### 3.8 CLEAN-UP AND DISPOSAL

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

-- End of Section --

## SECTION 07 51 13

BUILT-UP ASPHALT ROOFING  
05/12, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## ASTM INTERNATIONAL (ASTM)

ASTM C208 (2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board

ASTM C728 (2017; R 2022) Standard Specification for Perlite Thermal Insulation Board

ASTM C1153 (2010) Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging

ASTM D41/D41M (2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

ASTM D312/D312M (2016a) Standard Specification for Asphalt Used in Roofing

ASTM D448 (2012; R 2017) Standard Classification for Sizes of Aggregate for Road and Bridge Construction

ASTM D517 (1998; R 2008) Asphalt Plank

ASTM D1863/D1863M (2005; R 2011; E 2012) Mineral Aggregate Used on Built-Up Roofs

ASTM D1864/D1864M (1989; E 2009; R 2009) Moisture in Mineral Aggregate Used on Built-Up Roofs

ASTM D1970/D1970M (2019) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

ASTM D2170/D2170M (2018) Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)

ASTM D2178/D2178M	(2015a) Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D3617	(2007; R 2015; E 2015) Sampling and Analysis of New Built-Up Roof Membranes
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4402/D4402M	(2015) Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free
ASTM D4601/D4601M	(2004; R 2020) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D4637/D4637M	(2015) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D4869/D4869M	(2016a) Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing
ASTM D4897/D4897M	(2016) Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM D6162/D6162M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D6163/D6163M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
ASTM D6164/D6164M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM D6757/D6757M	(2018) Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing
ASTM E108	(2020a) Standard Test Methods for Fire Tests of Roof Coverings
FM GLOBAL (FM)	
FM 4470	(2016) Single-Ply, Polymer-Modified



Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction

FM APP GUIDE

(updated on-line) Approval Guide  
<http://www.approvalguide.com/>

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA RoofMan

(2020) The NRCA Roofing Manual

SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI RD-1

(2014) Performance Standard for Retrofit Drains

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star

(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

UNDERWRITERS LABORATORIES (UL)

UL 790

(2022) UL Standard for Safety Test Methods for Fire Tests of Roof Coverings

UL RMSD

(2012) Roofing Materials and Systems Directory

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM[S]

Asphalt applied, [four-ply felt, aggregate surfaced] [three-ply felt with granule-surfaced modified bitumen cap sheet] built-up roof membrane system.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wind Uplift Calculations; G[, [\_\_\_\_\_]]

Asphalt

Felts, including ply felt, base sheet and ventilating felt as applicable; G[, [\_\_\_\_\_]]

[ Granule Surface Modified Bitumen Cap Sheet; G[, [\_\_\_\_\_]]

] [ Heat Island Reduction; S

] [ Energy Star Label for Top Coating Product; S

] Flashing Membrane; G[, [\_\_\_\_\_]]

Fasteners

Primer

Asphalt Roof Cement

Walkpad Materials

Cant Strips

Certificate attesting that the fiberboard furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

Pre-Manufactured Accessories to be incorporated in the system installation; G[, [\_\_\_\_\_]]

Roof Walkways

Sample Warranties certificates; G[, [\_\_\_\_\_]]

Submit all data required with requirements of this section. Include in Data written acceptance by the roof membrane manufacturer of the products and accessories provided. List products in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

#### SD-06 Test Reports

Samples of Built-Up Roofing

Submit test results on roofing field samples as required, verifying composition of sample. Submit six copies of laboratory analysis within 30 calendar days after samples are taken. Submit reports in accordance with ASTM D3617.

#### SD-07 Certificates

Bill of Lading

Submit when labels of asphalt containers do not indicate the finished blowing temperature, flash point and equiviscous temperature.

Qualifications of Applicator

Submit evidence of the roofing system manufacturer's approval.

#### SD-08 Manufacturer's Instructions

Felts; G[, [\_\_\_\_\_]]

Flashings; G[, [\_\_\_\_\_]]

[ Modified Bitumen Cap Sheet; G[, [\_\_\_\_\_]]

Base Sheet attachment, including pattern and frequency of mechanical attachments required in field of roof, corners, and perimeters to provide for the specified wind resistance.

] Asphalt

Primer

Roof Cement

Fasteners

Cold Weather Conditions installation; G[, [\_\_\_\_\_]]

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. [ Include membrane manufacturer requirements for nailers and backnailing of roof membrane on steep slopes.] Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

SD-11 Closeout Submittals

Warranty

Information Card

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Qualifications of Applicator

The roofing system applicator must be approved, authorized, or licensed in writing by the roofing system manufacturer and must have a minimum of 3 years experience as an approved, authorized, or licensed applicator with the manufacturer and be approved at a level capable of providing the specified warranty.

##### 1.4.2 [Qualifications of Photovoltaics (PV) Rooftop Applicator

The PV rooftop applicator must be approved, authorized, or certified by a Roof Integrated Solar Energy (RISE) Certified Solar Roofing Professional (CSRPF), and comply with applicable codes, standards, and regulatory requirements to maintain the weatherproofing abilities of both the integrated roof system and photovoltaic system.

##### ]1.4.3 Fire Resistance

Complete roof covering assembly must:

- a. Be Class A rated in accordance with [ASTM E108](#) , FM 4470, or [UL 790](#); and
- b. Be listed as part of Fire-Classified roof deck construction in [UL RMSD](#), or Class I roof deck construction in [FM APP GUIDE](#).

##### 1.4.4 Wind Uplift Resistance

Provide a complete roof system assembly that is rated and installed to resist wind loads [indicated] [calculated in accordance with [ASCE 7-16](#)] and validated by uplift resistance testing in accordance with Factory Mutual

(FM) test procedures. Do not install non-rated systems except as approved by the Contracting Officer. Submit licensed engineer's [wind uplift calculations](#) and substantiating data to validate any non-rated roof system. Base wind uplift measurements on a design wind speed of [\_\_\_\_\_] mph in accordance with [ASCE 7-16](#) and other applicable building code requirements.

#### 1.4.5 Preroofing Conference

After approval of submittals and before performing roofing [and insulation] system installation work, hold a preroofing conference to review the following:

- a. Drawings and specifications and submittals related to the roof work;
- b. Roof system components installation;
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representatives to roof manufacturer;
- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and
- e. Quality control plan for the roof system installation;
- f. Safety requirements.

Coordinate preroofing conference scheduling with the Contracting Officer. The conference must be attended by the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing[ and insulation], flashing and sheet metal work, [ [mechanical][ and ] [electrical] work,] other trades interfacing with the roof work, [ Fire Marshall,] and a representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

### 1.5 DELIVERY, STORAGE, AND HANDLING

#### 1.5.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with manufacturer's labels intact and legible. Mark and remove wet or damaged materials from site. Where materials are covered by a referenced specification, container must bear specification number, type, and class, as applicable. Indicate on labels or [bill of lading](#) for roofing asphalt the asphalt type, finished blowing temperature (FBT), flash point (FP), and equiviscous temperature (EVT), that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with [ASTM D2170/D2170M](#) or 75 centipoise when tested in accordance with [ASTM D4402/D4402M](#). Deliver materials in sufficient quantity to allow work to proceed without interruption.

#### 1.5.2 Storage

Protect materials against moisture absorption, contamination, or other

damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms in dry locations in enclosed buildings or trailers with adequate ventilation. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work are finished and dry. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof and yet provide sufficient ventilation to prevent condensation. Maintain roll materials at temperature above 50 degrees F for a 24-hour period immediately prior to application. Keep aggregate dry as defined by ASTM D1863/D1863M. Place only those materials to be used during one day's work on the roof at one time. Remove unused materials from the roof at the end of each day's work. Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

### 1.5.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment so as not to damage materials or applied roofing.

## 1.6 ENVIRONMENTAL CONDITIONS

Do not install roofing during precipitation, or fog, or when air temperature is below 40 degrees F, or when there is ice, frost, moisture or visible dampness on roof deck. [ Restriction on application of roofing materials below 40 degrees F may be waived if Contractor devises a means, satisfactory to Contracting Officer, of: (1) maintaining surrounding temperature above 40 degrees F; (2) maintaining application temperature of heated materials without exceeding maximum specified heating temperature; and follows other recommendations of the membrane manufacturer for application in cold weather conditions.]

## 1.7 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counterflashing are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. [ Install roofing immediately following application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with complete felt ply installation the same day.]

## 1.8 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty to comply with the specified requirements. Provide a manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.

### 1.8.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20-year no dollar limit roof system materials and installation workmanship warranty, including flashing,

insulation, and accessories necessary for a watertight roof system construction. Write the warranty directly to the Government commencing at the time of Government's acceptance of the roof work. Provide the following statements for such warranty:

- a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.
- b. The warranty remains in full force and effect, including emergency temporary repairs performed by others, when the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification.

#### 1.8.2 Roofing System Installer Warranty

The roof system installer must warrant for a minimum period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

#### 1.8.3 Continuance of Warranty

Approve repair or replacement work that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

### 1.9 CONFORMANCE AND COMPATIBILITY

Provide the entire roofing and flashing system in accordance with specified and indicated requirements, including fire and wind resistance requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the [NRCA RoofMan](#), membrane manufacturer published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

### 1.10 ELIMINATION, PREVENTION OR CONTROL OF FALL HAZARDS

#### 1.10.1 Fall Protection

[\_\_\_\_\_]

## PART 2 PRODUCTS

## 2.1 GENERAL

Furnish a combination of specified materials that comprise the membrane manufacturer's standard system of the number and type of plies specified. Provide materials approved by the roof membrane manufacturer and suitable for the service and climatic conditions of the installation.

### 2.1.1 Energy [and Cool Roof] Performance

Install a roof system that meets an overall performance as specified on the drawings or by insulation specified in other sections. [ The roofing system will need to include a top surface finish that meets the criteria for Cool Roof Products. [ Provide emittance and reflectance percentages, solar reflectance index values, [ and ]slopes [\_\_\_\_], to meet sustainable third party certification requirements for [Heat Island Reduction](#). ] ]

## 2.2 FIBERGLASS FELT MATERIALS

- [ a. Venting Base Sheet: [ASTM D4897/D4897M](#), Type II, [without] [with] perforations and as approved by the roof membrane manufacturer.
- ] [b. Fiberglass Felt Base Sheet: [ASTM D4601/D4601M](#), Type II, [without] [with] perforations and as approved by the roof membrane manufacturer.
- ] c. Ply Felt: [ASTM D2178/D2178M](#), Type [IV] [ or ] [VI].

## 2.3 BASE [FLASHING MEMBRANE](#)

[ASTM D6163/D6163M](#). Membrane manufacturer's standard, minimum two-ply modified bitumen membrane flashing system compatible with the built-up roof membrane and as recommended in membrane manufacturer's published literature. Provide a minimum base ply of flashing membrane of [70 mils](#) thick. Provide a minimum granule surface modified bitumen flashing cap sheet of [120 mils](#) thick on the selvage edge.

## 2.4 [ASPHALT](#)

[ASTM D312/D312M](#), Type [II] [or] [III] [or] [IV], in accordance with membrane manufacturer requirements and compatible with the slope conditions of the installation.

## 2.5 SURFACING MATERIAL

### [2.5.1 Aggregate for Surfacing Built-up Roofing

Water-worn gravel, crushed stone, or crushed slag, conforming to [ASTM D1863/D1863M](#), or marble, expanded slag, or expanded shale, conforming to [ASTM D1863/D1863M](#) except density not less than [55 pcf](#). Aggregate conforming to gradation sizes No. 6, No. 7, and No. 67 in conformance with [ASTM D448](#) is acceptable provided other requirements of [ASTM D1863/D1863M](#) are met. Provide 2 percent maximum moisture content as determined by [ASTM D1864/D1864M](#). Provide light colored and opaque aggregate. Limestone, volcanic rock, crushed shells, and cinders are prohibited.

### ] [2.5.2 [Granule Surface Modified Bitumen Cap Sheet](#)

[[ASTM D6163/D6163M](#)] [[ASTM D6162/D6162M](#)] [[ASTM D6164/D6164M](#)]; Type II, Grade

G, minimum 3 mm (120 mils) thick at selvage edge, and as required to provide specified fire safety rating.

## ]2.6 PRIMER

ASTM D41/D41M for asphalt roofing systems and as approved by the membrane manufacturer.

## 2.7 ASPHALT ROOF CEMENT

ASTM D4586/D4586M for use with asphalt roofing systems, Type II for vertical surfaces and built-up bituminous flashings; Type I for horizontal surfaces and as recommended by the membrane manufacturer.

## 2.8 CANT STRIPS

Provide standard perlite cant strips conforming to ASTM C728 [ or wood fiber conforming to ASTM C208] treated with bituminous impregnation, sizing, or waxing and fabricated to provide maximum 45 degree change in direction of membrane. Provide minimum 1-1/2 inch thick cant strips and provide for minimum 5 inch face and 3-1/2 inch vertical height when installed at 45 degree face angle, except where clearance restricts height to lesser dimension.

## 2.9 UNSATURATED FELT OR ROSIN-SIZED BUILDING PAPER

Provide rosin-sized sheathing paper weighing minimum 5 pounds per 100 square feet or unsaturated felt weighing approximately 7-1/2 pounds per 100 square feet.

## 2.10 FASTENERS AND PLATES

Coated, corrosion resistant fasteners compatible with components being attached and contact surfaces. Conform to FM 4470 for fasteners for attachment to deck substrate of Class I roof deck construction and FM APP GUIDE for the wind resistance specified. Use hard copper fasteners in contact with copper; aluminum or stainless steel fasteners in contact with aluminum; and stainless steel fasteners in contact with stainless steel. For fastening only roofing felts, use fasteners driven through metal discs, or one-piece composite fasteners with heads not less than 1 inch in diameter or 1 inch square with rounded or 45-degree tapered corners.

### [2.10.1 Wood Substrates and Nailers

Provide 11 gage annular threaded shank nails with 7/16 to 5/8 inch diameter heads; or one-piece composite nails with annular threaded shanks not less than 11 gage for securing felts and metal items. Provide fasteners long enough to penetrate minimum 1 inch into or minimum 1/4 inch through wood substrate materials. Do not penetrate wood decking exposed to view on the underside.

### ] [2.10.2 Masonry or Concrete Walls and Vertical Surfaces

Provide hardened steel nails or screws with flat heads, diamond shaped points, and mechanically deformed shanks not less than 1 inch long for securing felts, metal items, and accessories. Use power-driven fasteners only when approved in writing by Contracting Officer.

### ]2.10.3 Metal Plates



Flat corrosion-resistant round stress plates as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of [FM 4470](#); minimum [2 inch](#) in diameter. Form discs to prevent dishing or cupping.

#### [2.11 [PRE-MANUFACTURED ACCESSORIES](#)

[Pre-manufactured accessories](#) must be manufacturer's standard for intended purpose, [ comply with applicable specification section,] compatible with the membrane roof system and approved for use by the roof membrane manufacturer.

##### [2.11.1 [Pre-fabricated Curbs](#)

Provide [[\\_\\_\\_\\_\\_](#)] gauge [G90 galvanized] [AZ55 galvalume] [[\\_\\_\\_\\_\\_](#)] curbs with minimum [4 inch](#) flange for attachment to roof nailers. Provide minimum height of [10 inch](#) above the finished roof membrane surface.

##### ] [2.11.2 [Photovoltaic \(PV\) Systems - Rack Mounted Systems](#)

Adhere to the following guidelines:

- a. *Building Owners Guide to Roof-mounted PV Systems*, published by NRCA.
- b. *Guidelines for Roof-Mounted PV Systems*, published by NRCA.

#### ]] [2.12 [WALKPADS](#)

Provide polyester reinforced roof walkpads, granule-surfaced modified bitumen membrane material, [ASTM D6162/D6162M](#) or [ASTM D6164/D6164M](#), minimum [[\\_\\_\\_\\_\\_](#)] [[200](#)] [mils](#) thick, compatible with the roof membrane and as recommended by the roof membrane manufacturer. Do not exceed [4 feet](#) in length for each panel. Other [walkpad materials](#) require approval of the Contracting Officer prior to installation.

##### 2.12.1 [ROOF WALKWAYS](#)

Provide [36 by 72 inch by 1/2 inch](#) thick asphalt planks, consisting of a homogeneous core of asphalt, plasticizers, and fillers bonded between two saturated and coated facing sheets. Top side must be surfaced with ceramic granules. Conform to [ASTM D517](#), mineral-surfaced asphalt.

##### ] [2.13 [PAVER BLOCKS](#)

Precast concrete, minimum [1-1/2 inch](#) thick, minimum [18 inch](#) square for walkways and minimum 150 mm by [6-inch by 12-inch](#) for use in supporting surface bearing components but extending not less than [2 inch](#) beyond all sides of surface bearing bases. Install walkpad material under all paver blocks.

##### ] [2.14 [ROOF INSULATION BELOW MEMBRANE SYSTEM](#)

Provide insulation compatible with the roof membrane, approved by the membrane manufacturer.

##### ] 2.15 [MEMBRANE LINER](#)

Self-adhering modified bitumen underlayment conforming to [ASTM D1970/D1970M](#),

EPDM membrane liner conforming to ASTM D4637/D4637M, or other waterproof membrane liner material conforming to ASTM D4869/D4869M, or ASTM D6757/D6757M, and as approved by the Contracting Officer.

#### [2.16 TOP COATING

Provide a top coating product that is Energy Star labeled and is produced and compatible with the roof material of this specification. Provide data identifying Energy Star label for top coating product. Install to the manufacturer's written installation methods. Provide written confirmation that installation of a top coat will not modify or void the required roof warranty.

#### ]PART 3 EXECUTION

##### 3.1 VERIFICATION OF CONDITIONS

Before applying roofing materials, ensure that the following exist:

- a. Do not install items that show visual evidence of biological growth.
- b. [Drains,] [curbs,] [cants,] [control joints,] [expansion joints,] [perimeter walls,] [roof penetrating components,] [and] [equipment supports] are in place.
- c. Surfaces are rigid, clean, dry, smooth, and free of cracks, holes, and sharp changes in elevation. Joints in substrate are sealed to prevent drippage of bitumen into building or down exterior walls. Inspect surfaces and approve immediately before application of roofing and flashings. Apply the roofing and flashings to a smooth and firm surface free from ice, frost, visible moisture, dirt, projections, and foreign materials.
- d. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 feet when checked with a 10 foot straight edge placed anywhere on the substrate.
- e. Substrate is sloped as indicated to provide drainage.
- f. Walls and vertical surfaces are constructed to receive counterflashing and will permit mechanical fastening of the base flashing materials.
- g. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inch above finished roofing surface.
- h. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, attachment flanges of sheet metal, and roof fixtures. [ Embedded nailers are flush with deck surfaces. ] [ Surface-applied nailers are same thickness as roof insulation. ]
- i. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is approximately 45 degrees and the height of the vertical leg is not less than nominal 3-1/2 inch. Lay cants in a solid asphalt mopping or coat of asphalt cement just prior to laying the roofing plies.
- [ j. Venting is provided in accordance with the following:

- [ (1) Edge Venting: Perimeter nailers are kerfed across width of the nailers to permit escape of gaseous pressure at roof edges.
- ] [ (2) Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.
- ]]
- [ k. Exposed nail heads in wood substrates are properly set. Warped and split [boards][sheets] have been replaced. There are no cracks or end joints 1/4 inch in width or greater. Knot holes are covered with sheet metal and nailed in place. [Wood][Plywood] decks are covered with rosin paper or unsaturated felt prior to base sheet or roof membrane application.[ Joints in plywood substrates are taped with 2 inch wide masking tape to prevent air leakage from the underside.]
- ] [l. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 1/4 inch in width. Insulation is being roofed over on the same day the insulation is installed.
- ] m. [Cast-in-place concrete substrates have been allowed to cure and the surface dryness requirements specified under paragraph FIELD QUALITY CONTROL have been met. ]No viable moisture present when conducting ASTM D4263.
- n. [Joints between precast concrete deck units, including weld plates, are grouted, leveled, and covered with 4 inch wide ply felt or other bituminous stripping membrane set in bituminous cement prior to applying other roofing materials over the area. ]Prior to application of primer on precast concrete decks, cover joints with a minimum 4 inch strip of felt or bituminous stripping membrane set in bituminous cement.

3.1.1.1 Summary Of Minimum Material Weights (Per 100 sq ft)

Asphalt assembly:

[Sheathing paper] [Base sheet]	[____pounds]
[Asphalt mopping] [Adhesive] to receive insulation	[____pounds]
Vapor retarder	[____pounds]
Roof insulation	[____pounds]
Asphalt mopping to receive base sheet	[____pounds]
Asphalt-saturated roofing felts ed roofing felts	[____pounds]
Asphalt moppings between felts ([____] at [____] pounds)	[____pounds]
Cap sheet	[____pounds]
Flood coat	[____pounds]

[Gravel] [Slag] [Aggregate] surfacing	[____] pounds]
Approximate total weight	[____] pounds]

### 3.2 PREPARATION

Verify that work of other trades that penetrates the roof deck or requires men and equipment to traverse the roof deck is complete.

Examine deck surfaces for inadequate anchorage, foreign material, moisture, and unevenness which would prevent the execution and quality of application.

Proceed with the roofing application only after defects have been corrected.

Starting work designates acceptance of the surfaces by the Contractor.

#### 3.2.1 Protection of Property

##### 3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoists and kettles prior to starting the work. Lap protective coverings not less than six inch, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

##### 3.2.1.2 Bitumen Stops

Provide felt bitumen stops or other means to prevent bitumen drippage at roof edges, openings, and vertical projections before hot mopped application of the roofing membrane. Form felt bitumen stops with two 12 inch wide strips of organic ply felt. Laminate with and set strips into a coating of asphalt roof cement with one-half of the width overhanging the edge of the roof or opening. Where nailers are provided, nail the strips with roofing nails spaced 12 inch on center in addition to embedding in asphalt roof cement. Protect the free portion of each strip from damage throughout the roofing period. After the plies of felt are in place, fold free portion of the strips back over the roofing membrane and embed in a continuous coating of asphalt roof cement. Secure with roofing nails spaced 3 inch on center.

#### 3.2.2 Equipment

##### 3.2.2.1 Mechanical Application Devices

Provide and maintain mechanical application devices with pneumatic tires that operate without damaging the insulation, roofing membrane, or structural components.

##### 3.2.2.2 Flame-Heated Equipment

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

##### [3.2.2.3 Open Flame Application Equipment

Use only open flame equipment recommended by the roofing materials manufacturer. Do not ignite open flame equipment when left unattended.

Provide and maintain a fire extinguisher adjacent to open flame equipment on the roof.

### ]3.2.3 Priming of Surfaces

Prime all surfaces to be in contact with adhered membrane materials. Apply primer at the rate of 3 liters per 0.75 gallon per 100 sq. ft. or as recommended by roof membrane manufacturer's printed instructions to promote adhesion of membrane materials. Allow primer to dry prior to application of membrane materials to primed surface. Avoid flammable primer material conditions in torch applied membrane base flashing applications.

#### [3.2.3.1 Priming of Concrete and Masonry Surfaces

After surface dryness requirements have been met, coat concrete and masonry surfaces which are to receive roofing and base flashing uniformly with primer. Allow primer to dry before application of roofing and flashing materials.

#### ]3.2.3.2 Priming of Metal Surfaces

Prime flanges of metal components to be embedded into the roofing system prior to setting in bituminous materials or stripping into roofing system.

### 3.2.4 Covering of Wood Substrate

Cover wood substrate with a layer of unsaturated felt or rosin-sized building paper lapped 2 inch at sides and 4 inch at ends. Nail to hold in place prior to application of roofing system.

### 3.2.5 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Provide visible working thermometer and thermostatic controls set to the temperature limits. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus 2 degrees F, to check temperatures of the asphalt frequently. When temperatures exceed maximum specified, remove asphalt from the site. Do not permit cutting back, adulterating, or fluxing of asphalt.

#### 3.2.5.1 Temperature Limitations for Asphalt

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its finished blowing temperature (FBT). Do not heat asphalt between 500 and 525 degrees F for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed membrane sheets when temperature of asphalt is within plus or minus 25 degrees F of the equiviscous temperature (EVT). Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

### 3.3 APPLICATION

Apply roofing materials as specified unless approved otherwise by the

Contracting Officer. Keep roofing materials dry before and during application. Except for aggregate surfacing, complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperature for asphalt. [Provide temporary roofing and flashing as specified herein prior to application of permanent roofing system.] Do not apply aggregate surfacing until the other roofing application procedures specified herein are completed.

### 3.3.1 Phased Membrane Construction

Phased application of membrane plies is prohibited. [Any delay in modified bitumen cap sheet installation will result in thorough cleaning of the applied membrane material surface and drying immediately prior to cap sheet installation. Priming of the applied membrane surface may be required at the discretion of the Contracting Officer prior to cap sheet installation.]

### [3.3.2 Temporary Roofing and Flashing

Provide watertight temporary roofing and flashing where considerable work by other trades, such as installing [cooling towers,] [antennas,] [pipes,] [ducts,] [\_\_\_\_\_,] is to be performed on the roof or where construction scheduling or weather conditions require protection of building interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

#### 3.3.2.1 Removal

Completely remove temporary roofing and flashing before continuing with application of permanent roofing system.

### ]3.3.3 Base Sheet Application - General

[[Fully adhere ] [Spot adhere ] base sheets in accordance with membrane manufacturer's printed instructions. [Provide spot adhesion with hot asphalt applied in 12 inch diameter spots installed in two staggered rows, centered 12 inch in from edge of the base sheet.] Roll and broom in the base sheet to ensure full contact with the hot asphalt application.] [On nailable substrates, mechanically fasten base sheet in conformance with specified wind resistance requirements and membrane manufacturer's printed instructions, and to include increased fastening frequency in corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate. Where applicable, base sheet may be mechanically fastened in conjunction with insulation to the substrate, in accordance with membrane manufacturers printed instructions.] Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 2 inch unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 6 inch and staggered a minimum of 36 inch. Apply sheets [at right angles to the roof slope so that the direction of water flow is over and not against the laps] [parallel to the roof slope] [so that plies of sheets extend from eave line on one side of the barrel-type roof and 18 inch over the center line of the crown of the roof. Apply sheets on the other side in the same manner, resulting in twice the normal amount of roofing sheets and asphalt at the crown]. Extend base sheets approximately 2 inch above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim base sheet to a neat fit around vent pipes, roof drains, and other projections through the roof. Retrofit roof drains must conform to

ANSI/SPRI RD-1. Application must be free of ridges, wrinkles, and buckles.

#### [3.3.3.1 Ventilating Base Sheets

Apply ventilating base sheet material recommended by the roof membrane manufacturer. Extend sheets over roof cants, up vertical surfaces, and terminate under cap flashing; at roof edges terminate sheets under outside edge of perimeter edge nailers or under gravel stop. [Top mop perforated ventilating base sheet with a full, continuous mopping of hot asphalt.]

#### ]3.3.4 Ply Felts

Ensure proper alignment of felts prior to installation. [Apply ply felts shingle fashion perpendicular to slope of roof, including application on areas of tapered insulation that change slope direction.] [Apply ply felts parallel to slope of roof [so that plies of felt extend from eave line on one side of barrel-type roof and 18 inch over center line of the crown of roof. Apply felts on other side in same manner, resulting in twice normal amount of roofing felts and asphalt at crown].] Bucking or backwater laps are prohibited. Apply felts in a continuous operation. Provide starter sheets of felt to maintain the specified number of plies throughout the roofing. Apply felts with side laps in accordance with the material manufacturer's printed instructions for the number of plies to be installed and in uniform alignment. Lap ends not less than 6 inch and stagger 36 inch minimum. Place the full width of each ply in hot bitumen immediately behind the bitumen applicator. Lay plies free of wrinkles, creases, ridges, or fishmouths. Extend felts approximately 2 inch above top of cant strips at vertical surfaces and to top of cant strips elsewhere. Trim felts to a neat fit around vent pipes, roof drains, and other projections. Avoid traffic on mopped surfaces when the bitumen is fluid and for a minimum of one hour after ply application.

#### 3.3.4.1 Hot-Mopping of Ply Felts

Bond plies to each other and to the [base sheets] [substrate] with hot asphalt. Apply felts immediately following application of asphalt. Do not work ahead with asphalt. At the instant felts come into contact with asphalt, asphalt must be completely fluid, with asphalt temperatures within specified EVT range. Apply asphalt uniformly in a full, continuous mopping and firmly bonding film. Apply asphalt at the rate of approximately 25 pounds per 100 sq. feet plus or minus 25 percent. Require application rate on the high end of the application range when mopping directly to absorptive insulation substrates of perlite and woodfiber. As felts are rolled into the hot asphalt, immediately squeegee, roll or broom down to eliminate trapped air and to provide tight, smooth laminations without wrinkles, buckles, kinks, or fish mouths. Bitumen must be visible beyond all edges of each ply as it is being installed. Install individual ply and the completed roof membrane system free of air pockets, felt delaminations, ridges, creases, fishmouths, dry laps, or blisters. Do not lay felts dry or turn back laps for mopping between plies.

#### [3.3.4.2 Backnailing of Ply Felts

Unless otherwise recommended by the roof membrane manufacturer and approved by the Contracting Officer, [provide minimum 3-1/2 inch wide nailing strips matching insulation thickness and applied perpendicular to roof slope for backnailing of roof membrane. Space nailing strips as recommended by the membrane manufacturer, but not exceeding 16 feet on center unless approved otherwise by the Contracting Officer. Coordinate the nailer installation

with insulation requirements. As the felt plies are installed, nail each ply 1 inch from the leading edge at each nailer line.] [fasten each felt ply 1 inch from the leading edge and spaced at maximum 15 feet on center along the leading edge.] Provide fasteners with a 1 inch diameter metal cap or fasten through 1 inch diameter caps. Set fasteners firm and flush without puncturing felt ply. Conceal fasteners with succeeding plies of felt.

#### ]3.3.4.3 Valleys and Ridges

Valleys: Apply roofing at valleys and waterways in the following manner:

Continue base sheets across valleys and terminate 18 inch from the valley.

Continue felt plies across valleys and terminate 12 inch from the valley. Terminate exposed laps on a line 12 inch from, and parallel to, the gutter valley. Provide two plies of felt, 9 and 12 inch wide, successively mop in over each felt line of the termination.

If the application can be completed without wrinkles, buckles, or fishmouths and if side laps do not face the direction of drainage, roofing felts and base sheets may be laid continuously across or parallel to shallow valleys such as those formed by reverse-slope roofs. For this application, reinforce valleys with one ply of felt, wide, center on the valley gutter and lay in a solid mopping of asphalt over the top ply of roofing.

#### 3.3.5 Membrane Flashing

Provide two plies of modified bitumen membrane strip flashing and sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, and where necessary to make the work watertight. Top ply of flashing must be granule-surfaced modified bitumen membrane. Install flashing after plies of roof membrane felt have been applied but before aggregate surfacing is applied. Cut at a 45 degree angle across terminating end lap area of cap membrane prior to applying adjacent overlapping cap membrane. Press flashing into place to ensure full adhesion and avoid bridging. Ensure full lap seal in all lap areas. Mechanically fasten top edge of base flashing 6 inch on center through minimum 1 inch diameter tin caps with fasteners of sufficient length to embed minimum 1 inch into attachment substrate. [ Apply matching granules in any areas of asphalt bleed out while the asphalt is still hot.] Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components.

##### 3.3.5.1 Strip Flashing

Set primed flanges of sheet metal flashings to be incorporated into roofing system in a uniform coating of asphalt roof cement not less than 1/16 inch thick applied over the ply felts. Strip-in with one layer of smooth surface modified bitumen membrane and cap with granule-surfaced modified bitumen membrane. Set strip flashing in hot asphalt or cement to the tops of the flanges, roofing membrane, and to each other. Use coatings of asphalt roof cement not less than 1/16 inch thick for ply felt. Use hot asphalt or modified bitumen cement for modified bitumen sheets. Extend first stripping ply not less than 4 inch beyond outer edge of flange onto roof membrane. Extend each additional ply 4 inch beyond the edge of the



previous ply.

#### [3.3.5.2 Membrane Flashing at Roof Drain

Extend roofing plies to edge of drain bowl opening at roof drain deck flange. Neatly fit and press primed roof drain flashing into heavy coat of asphalt roof cement applied to top of roofing plies. Strip in and completely cover flashing with two layers of modified bitumen sheet, extending the first sheet **6 inch** on the roofing beyond the edge of flashing. Extend the cap sheet **6 inch** beyond the previous flashing ply. Bond the two layers to the metal flashing and to each other with hot asphalt. Securely clamp membrane, metal flashing, and strip flashing in the flashing clamping ring. Secure clamps so that strip flashing and metal flashing are free from wrinkles and folds. Trim membrane, flashing, and stripping flush with inside of clamping ring.

#### ] [3.3.5.3 Pre-fabricated Curbs

Anchor prefabricated curbs securely to nailer or other base substrate as indicated and flash with modified bitumen flashing membrane.

#### ] 3.3.5.4 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories are set on the membrane, adhere walkpad material to bottom of accessories prior to setting on roofing membrane. Install set-on accessories to permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

#### 3.3.5.5 Lightning Protection

Flash or attach lightning protection system components to the roof membrane in a manner acceptable to the roof membrane manufacturer.

#### [3.3.6 Roof Walkpads

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the modified bitumen sheet roofing manufacturer's printed instructions. Provide minimum **6 inch** separation between adjacent walkpads to accommodate drainage. Provide walkpad [or an additional layer of cap sheet] under precast concrete paver blocks to protect the roofing.

#### ] [3.3.7 Elevated Metal [Walkways] [and] [Platforms]

Provide protection mat of walkpad material, or other material approved by the Contracting Officer, at all surface bearing support locations.

#### ] 3.3.8 Paver Blocks

Install paver blocks where indicated and as necessary to support surface bearing items traversing the roof area. Set paver block on a layer of walkpad [or modified bitumen cap sheet] applying over the completed roof membrane.

#### [3.3.9 Aggregate Surfacing

After completion of roof membrane ply and flashing installation, and

correction of tears, gouges or other deficiencies in the installed work, apply aggregate surfacing. Uniformly flood coat the surface with hot asphalt at a rate of approximate 60 pounds per square. While asphalt is still hot, apply gravel aggregate surfacing material at a rate of 400 pounds per square. Provide for full and uniform coverage of the roof surface. Approximately 50 percent of the aggregate must be solidly adhered in the asphalt.

] [3.3.10 Granule-Surfaced Modified Bitumen Cap Sheet

Inspect underlying applied membrane and repair free of damage, holes, puncture, gouges, abrasions, and any other defects, and free of moisture, loose materials, debris, sediments, dust, and any other conditions required by the membrane manufacturer prior to cap sheet installation. Provide cleaning and artificial drying with heated blowers or torches to ensure clean, dry surface prior to cap sheet application. When delays in cap sheet installation may have occurred, do not apply cap sheet if underlying materials have been exposed to rain or frozen precipitation within the previous 24 hours. Unroll cap sheet membrane and allow to relax a minimum of 1 hour prior to installation and as otherwise recommended by the membrane manufacturer. Apply cap sheet in same direction as the underlying felt plies. Align cap membrane and apply with minimum 3 inch side laps and minimum 6 inch end laps and as otherwise required by membrane manufacturer. Set cap sheet in hot asphalt. Cap sheet may be torch applied with approval of the Contracting Officer and written approval of the felt membrane manufacturer, and as recommended by the modified bitumen membrane manufacturer. Cut at a 45 degree angle across selvage edge of cap membrane to be overlapped in end lap areas prior to applying overlapping cap membrane. [ Apply matching granules in any areas of bitumen bleed out while the bitumen is still hot]. Minimize traffic on newly installed cap sheet membrane.

[3.3.10.1 Backnailing of Cap Sheet Membrane

Unless otherwise recommended by the roof membrane manufacturer and approved by the Contracting Officer, install the modified bitumen cap sheet to provide for end laps at nailer locations. Nail the modified bitumen cap sheet at the end lap area across the width of the sheet. Nail within 1 inch of each edge of the sheet and at 8 to 8-1/2 inches center across the width of the sheet in a staggered fashion. Provide nails with a 1 inch diameter metal cap or nail through 1 inch diameter caps. Cover nails by overlapping adjacent upslope sheet at the end lap area.

] ]3.3.11 Correction of Deficiencies

Where any form of deficiency is found, take additional measures to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer. [ Where interply moppings are too light, apply additional two plies of felt in full moppings of asphalt. Apply with 4 inch side and end laps. Where free water, skips, excessive voids, dry laps, desponding or any form of delamination are discovered between the plies, remove and rebuild affected area. Correction of inadequate number of plies, improper lap widths, or non-uniform or excessive asphalt mopping must be as directed by the Contracting Officer.] Where insulation is found to be wet, remove insulation and provide new built-up roofing and insulation.

3.3.12 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

### 3.4 PROTECTION OF APPLIED ROOFING

#### 3.4.1 Protection Against Moisture Absorption

When precipitation is imminent and at the end of each day's work, protect applied roofing as follows:

##### [3.4.2 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of modified bitumen roofing system in an effective manner. [ Seal off flutes in metal decking along the cutoff edge.] Remove the water cutoffs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

##### ]3.4.3 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Remove temporary flashing before applying permanent flashing.

#### 3.4.4 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

##### [3.4.5 Glaze Coat

Use light glaze coating of bitumen to waterproof roof areas requiring extended time to complete. Glaze coating must be at the discretion of the Contracting Officer. Apply bitumen glaze coat on exposed felts at a rate of **5 to 10 pounds per square**. Lower application rates, in accordance with membrane manufacturer's recommendations, may be required when **modified bitumen cap sheet** surfacing is specified. Provide valleys and low areas that may pond water with glaze coating.

### ]3.5 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

#### 3.5.1 Test for Surface Dryness

Before application of insulation or membrane materials and starting work on the area to be roofed, perform test for surface dryness in accordance with the following:

- a. **Foaming:** When poured on the surface to which materials are to be applied, one pint of asphalt when heated in the range of **176 to 350 to 400 degrees F**, must not foam upon contact.
- b. **Strippability:** After asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a

portion of the sample be readily stripped clean from the surface, do not consider the surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been tested by the method above and found dry.

- c. Prior to installing any roof system on a concrete deck, conduct a test per [ASTM D4263](#). The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

### 3.5.2 Construction Monitoring

During progress of the roof work, perform visual inspections to ensure compliance with specified parameters. Additionally, verify the following:

- a. Equipment is in working order. Metering devices are accurate.
- b. Materials are not installed in adverse weather conditions.
- c. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

The proper number, type, and spacing of fasteners are installed.

Materials comply with the specified requirements.

All materials are properly stored, handled and protected from moisture or other damages.

Asphalt is heated and applied within the specified temperature parameters.

Hot asphalt application is provided uniformly for voidless coverage and as necessary to ensure full adhesion of materials. Materials are set in place while asphalt is within the specified temperature range.

The proper number and types of plies are installed, with the specified overlaps.

Applied membrane surface is inspected, cleaned, dry, and repaired as necessary prior to cap sheet installation.

Membrane is without ridges, wrinkles, kinks, fishmouths, or other voids or delaminations.

Installer adheres to specified and detailed application parameters.

Associated [flashings](#) and sheet metal are installed in a timely manner in accord with the specified requirements.

Temporary protection measures are in place at the end of each work shift.

### [3.5.2.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three [\_\_\_\_\_] times [once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place. [Inspect during the first 20 squares of membrane installation, at mid-point of the installation, and at substantial completion prior to surfacing application, at a minimum. Additional inspections must not exceed one for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer.] After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. The report must note overall quality of work, deficiencies and any other concerns, and recommended corrective action.

### ]3.5.3 Samples of Built-Up Roofing

After application of specified roofing felts and prior to applying surfacing, take field samples of built-up roofing as directed by the Contracting Officer. Take and test samples in accordance with [ASTM D3617](#) and at locations selected by the Contracting Officer immediately prior to cutting. Cut 4 inch by 40 inch samples across felt laps in a manner to expose the specified number of plies. The 4 inch edge must coincide with an edge lap of felt and not be positioned over an end lap. Use 4 inch by 40 inch samples for visual inspection. The Contracting Officer will inspect the samples for the specified number of plies, bond between plies, skips in interply moppings, uniform asphalt mopping, presence of excessive voids or large voids in the ply construction, presence of harmful foreign materials, visible presence of moisture in the sandwich and wet insulation. Use 300 mm by 12 inch by 12 inch cut samples to calculate bitumen quantities in accordance with [ASTM D3617](#) and directed by the Contracting Officer. Do not proceed with surfacing until all deficiencies disclosed as a result of cut tests have been corrected and approved by the Contracting Officer. Where cuts are not retained by the Contracting Officer or disposed, set cut strip back in cut area and patch as specified.

#### 3.5.3.1 Number of Cut Tests

Take cut samples as directed by the Contracting Officer for quality assurance validation or as necessary to determine the extent of deficiencies discovered in the construction. Except where cut samples are taken to investigate deficiencies, provide no more than two cut samples per 100 squares or one cut sample from each day's work.

#### 3.5.3.2 Sample Cutting Device

Provide a rectangular, 4 inch by 40 inch template and 12 inch by 12 inch template, of a type that will permit accurate cutting of samples with standard roofing knives. Keep cutting edge of knife clean by washing in solvent after each cut.

#### 3.5.3.3 Patching Cut-Out Area

Immediately after inspection, replace cut-out sample. When sample is needed for laboratory analysis or other circumstance makes it unavailable, substitute a new section of equivalent size and structure. For non-nailable decks, replace sample in hot asphalt. For nailable decks, insert one ply of ply felt into opening from which sample was taken and

sprinkle nail to hold in place; coat felt heavily with asphalt roof cement and press cutout sample firmly into asphalt roof cement. Repair area of cut with new patch of the same number of plies as the primary roof membrane. Extend the first ply minimum 6 inch all around the cut area. Extend each additional ply minimum 4 inch beyond the previous ply.

#### [3.5.4 Roof Drain Test

After roofing system is complete except for surfacing, perform the following test of roof drains and adjacent roofing for watertightness. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect the installation. Repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

#### ] [3.6 INFRARED INSPECTION

[Eight] [\_\_\_\_\_] months after completion of the roofing system, the Contractor must inspect the roof surface using infrared (IR) scanning as specified in ASTM C1153. Where the IR inspection indicates moisture intrusion, replace wet insulation and damaged or deficient materials or construction in a manner to provide watertight construction and maintain the specified roof system warranties. [ Coordinate infrared inspections with building envelope commissioning activities.]

#### ] 3.7 INFORMATION CARD

For each roof, furnish a typewritten information card for facility records and a photoengraved 0.032 inch thick aluminum card for exterior display. Card must be 8-1/2 by 11 inch minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --

## SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING  
05/12, CHG 5: 11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.24 (2022) Roofing - Safety Requirements for Low-Sloped Roofs

## ASPHALT ROOFING MANUFACTURER'S ASSOCIATION (ARMA)

ARMA 410BUR88 (2001) Manual of Roof Maintenance and Repair

ARMA PMBRG98 (1998) Quality Control Guideline for the Application of Polymer Modified Bitumen Roofing

## ASTM INTERNATIONAL (ASTM)

ASTM C208 (2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board

ASTM C552 (2022) Standard Specification for Cellular Glass Thermal Insulation

ASTM C578 (2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C726 (2017) Standard Specification for Mineral Wool Roof Insulation Board

ASTM C728 (2017; R 2022) Standard Specification for Perlite Thermal Insulation Board

ASTM C1153 (2010) Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging

ASTM C1289 (2022) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D312/D312M	(2016a) Standard Specification for Asphalt Used in Roofing
ASTM D1668/D1668M	(1997a; R 2014; E 2014) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D1863/D1863M	(2005; R 2011; E 2012) Mineral Aggregate Used on Built-Up Roofs
ASTM D1970/D1970M	(2019) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D2170/D2170M	(2018) Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)
ASTM D2824/D2824M	(2018) Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, and Fibered without Asbestos
ASTM D4073/D4073M	(2006; E 2019; R 2019) Standard Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4402/D4402M	(2015) Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free
ASTM D4601/D4601M	(2004; R 2020) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D4637/D4637M	(2015) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D4897/D4897M	(2016) Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM D5147/D5147M	(2014) Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
ASTM D6162/D6162M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified



	Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D6163/D6163M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
ASTM D6164/D6164M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM D6222/D6222M	(2016) Standard Specification for Atactic Polypropylene (ARP) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM D6223/D6223M	(2016) Standard Specification for Atactic Polypropylene (ARP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D6298	(2016) Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet with a Factory Applied Metal Surface
ASTM E108	(2020a) Standard Test Methods for Fire Tests of Roof Coverings
FM GLOBAL (FM)	
FM 4470	(2016) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IBC	(2018) International Building Code
INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)	
ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices
MIDWEST ROOFING CONTRACTORS ASSOCIATION (MRCA)	
CERTA	(2007) NRCA/MRCA Certified Roofing Torch Applicator Program
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	

NFPA 58 (2020; TIA 20-1; TIA 20-2; TIA 20-3)  
Liquefied Petroleum Gas Code

NFPA 241 (2022) Standard for Safeguarding  
Construction, Alteration, and Demolition  
Operations

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA C3701 (1997) Repair Manual for Low Slope  
Membrane Roof Systems

NRCA CONDET (2014) Construction Details Manual

NRCA RoofMan (2020) The NRCA Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA 1793 (2012) Architectural Sheet Metal Manual,  
7th Edition

SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI/FM 4435/ES-1 (2017) Test Standard for Edge Systems Used  
with Low Slope Roofing Systems

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy  
Efficiency Labeling System (FEMP)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1910.12 Construction Work

29 CFR 1926 Safety and Health Regulations for  
Construction

29 CFR 1926.16 Rules of Construction

UNDERWRITERS LABORATORIES (UL)

UL 790 (2022) UL Standard for Safety Test Methods  
for Fire Tests of Roof Coverings

UL RMSD (2012) Roofing Materials and Systems  
Directory

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM[S]

[ [Minimum [two-ply][three-ply] SBS [or] [APP] [modified bitumen roof  
membrane consisting of [modified bitumen base sheet][fiberglass felt  
[venting ]base sheet] [,interply sheet] and cap sheet. Modified bitumen  
roof membrane must be [set in hot asphalt][torch applied]][set in  
cold-applied adhesive].]

][[\_\_\_\_]: Minimum [two-ply][three-ply] SBS [or] [APP] modified bitumen roof membrane consisting of [modified bitumen base sheet][fiberglass felt [venting ] base sheet] [,interply sheet] and cap sheet. Modified bitumen roof membrane must be [set in hot asphalt][torch applied][set in cold-applied adhesive].

] All work must follow the **NRCA RoofMan** guidelines and standards stated within this Section.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section **01 33 00 SUBMITTAL PROCEDURES**:

#### SD-02 Shop Drawings

**Roof Plan; G[, [\_\_\_\_]]** drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, as applicable

#### **Field Inspection and Existing Conditions Report**

Identify all fire safety issues including exposed or concealed combustible materials, which may require additional protection during roof installation.

#### SD-03 Product Data

**Modified Bitumen Sheets; G[, [\_\_\_\_]]**

[ **Heat Island Reduction; S**

][ **Energy Star Label for Top Coating; S**

][ **Asphalt**

][ **Cold-Applied Membrane Adhesive; G[, [\_\_\_\_]]**

][ **Fiberglass Felt; G[, [\_\_\_\_]]**

] **Primer; G[, [\_\_\_\_]]**

**Modified Bitumen Roof Cement; G[, [\_\_\_\_]]**

[ **Pre-Manufactured Accessories**

] **Fasteners And Plates; G[, [\_\_\_\_]]**

Sample **Warranty** certificate; G[, [\_\_\_\_]]

Submit all data required by Section **07 22 00 ROOF AND DECK INSULATION**, together with requirements of this section. Include in data written acceptance by the roof membrane manufacturer of the products and accessories provided. Provide products as listed

in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

#### SD-05 Design Data

Wind Uplift Calculations; G[, [\_\_\_\_]]

[ Provide Engineering calculations, signed, sealed, and dated by a qualified Engineer validating the wind resistance per ASCE 7-16, ASTM D4073/D4073M, and ANSI/SPRI/FM 4435/ES-1 of non-rated roof system.

#### ] SD-07 Certificates

Provide evidence that products used within this specification are manufactured in the United States.

##### Qualification of Manufacturer

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph QUALIFICATION OF MANUFACTURER.

##### Qualification of Applicator

Certify that the applicator meets requirements specified under paragraph QUALIFICATION OF APPLICATOR.

[ Qualification of Torch Operator; G[, [\_\_\_\_]]

Certify that the torch operator(s) meet requirements specified under paragraph QUALIFICATION OF TORCH OPERATOR. Submit a valid copy of each applicator's Certified Roofing Torch Applicator (CERTA) card.

] Qualification of Engineer of Record

Certify that the Engineer of Record is fully qualified, competent, and currently licensed to practice in the project jurisdiction.

[ Bill of Lading

Submit bill of lading when labels of asphalt containers do not bear the flash point (FP), finished blowing temperature (FBT), and equiviscous temperature (EVT).

] Wind Uplift Resistance; G[, [\_\_\_\_]] classification, as applicable

Fire Resistance classification; G[, [\_\_\_\_]]

Submit the roof system assembly [wind uplift and] fire rating classification listings.

#### SD-08 Manufacturer's Instructions

Modified Bitumen Membrane Application; G[, [\_\_\_\_]]

Flashing; G[, [\_\_\_\_]]

- [ Temperature Limitations for Asphalt
- ] [ Torches
- ] [ Cold Adhesive Applied Modified Bitumen Membrane; G[, [\_\_\_\_]]
- ] [ Base Sheet attachment, including pattern and frequency of mechanical attachments required in field of roof, corners, and perimeters to provide for the specified wind resistance.
- ] Primer
- Fasteners
- Ventilating Base Sheets
- [ Coating Application; G[, [\_\_\_\_]]
- ] Cold Weather Installation; G[, [\_\_\_\_]]
- Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. [ Include membrane manufacturer requirements for nailers and backnailing of roof membrane on steep slopes.] Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

#### SD-11 Closeout Submittals

##### Warranty

##### Information Card

##### Instructions To [Government] [Contractor] Personnel

Include copies of Safety Data Sheets for maintenance/repair materials.

Submit 20 year "No-Dollar-Limit" warranty for labor and materials.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer must have a minimum of [5][\_\_\_\_] years experience in manufacturing modified bitumen roofing products.

##### 1.4.2 Qualification of Applicator

Roofing system applicator must be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and have a minimum of [five][\_\_\_\_] years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator must supply the names, locations and client contact information of five projects of similar size and scope that the applicator has constructed using the

manufacturer's roofing products submitted for this project within the previous three years.

#### 1.4.3 Qualification of Torch Operator

Torch applicators must be CERTA certified to operate torch equipment and must maintain and carry a valid Certified Roofing Torch Applicator (CERTA) card.

#### 1.4.4 Qualifications of Photovoltaics (PV) Rooftop Applicator

The PV rooftop applicator must be approved, authorized, or certified by a Roof Integrated Solar Energy (RISE) Certified Solar Roofing Professional (CSRPF), and comply with applicable codes, standards, and regulatory requirements to maintain the weatherproofing abilities of both the integrated roof system and photovoltaic system.

#### 1.4.5 Qualification of Engineer of Record

[ Engineer of Record must be currently licensed within the jurisdiction of the project.

] [Engineer of Record must be approved, authorized, and currently licensed by the state of [Florida] [\_\_\_\_], and have a minimum of five years experience as an approved Engineer for manufacturers of similar roof systems. Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. Engineer of Record must provide certified engineering calculations for:

] [Wind uplift requirements] [in accordance with [Local and State codes]

**ASCE 7-16**, in accordance with International Building Code.

[Seismic requirements per [local] [and state] building codes]

[ Seismic requirements per **ICC IBC** Chapter 16, Section 1608.3

] [Snow load requirements per **ICC IBC** Chapter 16 Section 1608.3 and Section 7 of **ASCE 7-16**

#### ] 1.4.6 Fire Resistance

Complete roof covering assembly must:

- a. Be Class A [or B] rated in accordance with **ASTM E108**, FM 4470, or **UL 790**; and
- b. Be listed as part of Fire-Classified roof deck construction in **UL RMSD**, or Class I roof deck construction in **FM APP GUIDE**.

FM or UL approved components of the roof covering assembly must bear the appropriate FM or UL label.

#### 1.4.7 Wind Uplift Resistance

Provide a complete roof system assembly that is rated and installed to resist wind loads [indicated] [calculated in accordance with **ASCE 7-16**] and

validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Do not install non-rated systems, except as approved by the Contracting Officer. Submit licensed engineer's [Wind uplift calculations](#) and substantiating data to validate any non-rated roof system. Base wind uplift measurements on a design wind speed of [\_\_\_\_\_] mph in accordance with [ASCE 7-16](#) and other applicable building code requirements.

#### 1.4.8 Preroofing Conference

After approval of submittals and before performing roofing [and insulation] system installation work, hold a preroofing conference to review the following:

- a. Drawings, including [Roof Plan](#), specifications and submittals related to the roof work
- b. Roof system components installation
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roof structure, and roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representatives to roof manufacturer
- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing
- e. Quality control, (ARMA PMBRG98) plan for the roof system installation
- f. [Field inspection and existing conditions report](#) identifying all fire safety issues including exposed or concealed combustible materials, which may require additional protection during roof installation
- g. Safety requirements

Coordinate preroofing conference scheduling with the Contracting Officer. The conference must be attended by the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing [and insulation], [torch operator,] flashing and sheet metal work, [[mechanical] [and] [electrical] work], other trades interfacing with the roof work, designated safety personnel trained to enforce and comply with [ASSP A10.24](#), [ Fire Marshall,] and a representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container must bear the specification number, type, and class, as applicable. [Labels or [bill of lading](#) for roofing asphalt must indicate asphalt type, FP, FBT, and EVT, that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with

ASTM D2170/D2170M or 75 centipoise when tested in accordance with ASTM D4402/D4402M.] Deliver materials in sufficient quantity to allow work to proceed without interruption.

### 1.5.2 Storage

Protect materials against moisture absorption and contamination or other damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof. Provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

Maintain a minimum distance of 35 foot for all stored flammable materials, including materials covered with shrink wraps, craft paper or tarps from all torch/welding applications.

Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

### 1.5.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials or applied roofing.

## 1.6 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Follow manufacturer's printed instructions for Cold Weather Installation.

## [1.7 [TORCH] [HOT-MOPPED ASPHALT] APPLIED [(HEAT WELD)] MODIFIED BITUMEN MEMBRANE SAFETY

### 1.7.1 Property Protection

Take all precautions necessary to prevent ignition of combustible materials during [torch application] [hot-mopped asphalt application] of roofing. Immediately call the fire department if a fire commences. Review all fire safety procedures as outlined at the pre-roofing conference.

Install materials using the techniques recommended by CERTA NRCA/MRCA Certified Roofing Torch Applicator Program available from the National Roofing Contractors Association (NRCA) and the Midwest Roofing Contractors Association (MRCA) as endorsed by the Asphalt Roofing Manufacturers Association (ARMA) and the United Union of Roofers, Waterproofers and



Allied Workers. Application procedures must comply with NFPA 241, OSHA 29 CFR 1910 and 29 CFR 1910.12, 29 CFR 1926.16, 29 CFR 1926 Subpart F., UL Fire Resistance Directory Volume No. 1, NRCA R&W Manual, and Florida Building Code Volume 2004.]

Do not store flammable liquids on the roof.

Provide a minimum of two 2.65 gallon containers of water and two fully charged minimum [ 20 pound CO2] [ 20 pound ABC (dry chemical)] fire extinguishers in separate, easily accessible locations on the roof and within [ 30 foot] [10 foot] of each [torch work area] [hot-mopped kettle] at all times.

No Asphalt Kettles are allowed on roofs. Locate kettles and supply LP-Gas Cylinders safely and secured per NFPA 241 outside of the building's perimeter a minimum of 20 foot from the structure and any combustible materials.

Maintain a minimum separation of 20 foot between LP-Gas Cylinders and kettle. Provide protective fire retardant blanket barrier or shield between any building structure to a minimum height of 8 foot and a clear surround distance of 4 foot if operations force placement of kettle within a distance of 20 foot. Do not obstruct or place kettles or Cylinder storage within 10 foot of exits, means of egress, gates, roadways, entrances. Locate kettles downwind and away from any building air intakes.

Provide a minimum of two portable fully charged [ 20 pound CO2] [ 20 pound ABC (dry chemical)] fire extinguishers no closer than 5 foot and no further than 25 foot of horizontal travel distance from each kettle at all times while kettle is in operation, in easily accessible and identifiable locations. Also provide [a minimum of one] [two] multipurpose 2-A:20-B:C portable fire extinguisher on the roof being covered or repaired.

Comply with the following safety procedures:

- a. Fuel containers, burners, and related appurtenances of roofing equipment in which liquefied petroleum gas is used for heating must comply with the requirements of NFPA 58.
- b. Fuel containers having capacities greater than one pound must be located a minimum of 10 foot clear distance from the burner flame.
- c. Clearly label all LP-Gas Cylinders as "Flammable Gas", and secure to prevent accidental tip-over.
- d. Check all pressure regulators and hoses prior to use for proper functioning and integrity.
- e. Turn off fuel supply at LP Gas Cylinder when kettle is not in use.
- f. Equip all kettles with a functioning temperature measuring device to ensure no heating in excess of 50 degrees F below the flash point.
- g. Provide covers, lid, or top which are close fitting, constructed of minimum No.14 manufacturer's gauge steel, and can be gravity closed on all kettles.
- h. Clean all roofing mops and rags free of excess asphalt and store safely away from all combustible materials. Store discarded roofing mops and

rags in a non-combustible container and remove from site each day.

- i. Position all pump lines handling hot asphalt securely and equip all pump lines with a shut-off valve on each with a coupler which may be opened when lines are full. Do not subject pump lines to pressures in excess of safe and recommended NRCA and ARMA working pressures. Station an operator near the equipment to cut off flow and care for other emergencies while conducting heating, pumping and application operations.
- j. Asphalt bucket used by roofers or workers in similar trades must be constructed of minimum No. 24 gauge or heavier sheet steel and have a metal bail of no less than 1/4 inch diameter material. The bail is to be fastened to offset ears or equivalent which have been riveted, welded, or otherwise safely and securely attached to the bucket. Soldered bail sockets are prohibited. Position workers and other employees to avoid being struck by bucket or other roofing materials, which may accidentally fall while being hoisted, lowered, or used in the roofing operation. Provide safety barriers and caution signs at all skylights or other roof holes.
- k. Do not use flammable liquids with a flash point below 100 degrees F (gasoline and similar products) for cleaning purposes.

Do not use solid fuel or Class I liquids as fuel for roofing asphalt kettles. Provide a minimum of one employee fully knowledgeable of kettle operations and hazards to maintain constant surveillance during kettle operation within a minimum distance of 25 foot of the kettle.

Check all fire extinguishers prior to commencement of work, and upon completion of the day's work, to ensure fullness and operability.

Project supervisor must make daily inspections with the facility manager of all conditions and operations which could present hazards during [torching] [hot-mopped] applications and issue directives to address all such concerns and items of the work and existing conditions.

Identify and protect all combustible roof components, possible fire traps, and hidden hazards. Seal off voids or openings in the substrate with non-combustible materials prior to installing [torch-applied] [hot-mopped applied] materials in the area. Install protective fire retardant blankets and shields at building walls, eaves, parapets and equipments curbs constructed of combustible materials within 3 foot radius of the area of [torch work] [hot-mopped kettle] prior to commencement of the work.

When working around intakes and openings, temporarily disconnect and block to prevent [flame of torch] [fumes from kettle] from being drawn into the opening. [ Provide non-combustible shielding or flame guard protection where gaps or voids occur in the construction in area of torch work.]

#### 1.7.2 Fire Watch

All personnel on the roof during [torch application] [hot-mopped application] must be properly trained to use a fire extinguisher. Provide a fire watch for a minimum of [two hours after completion of all torch work] [30 minutes after completion of hot-mopped kettle operations] at the end of each work shift. Maintain the fire watch for additional time required to ensure no potential ignition conditions exist. [Utilize heat sensing meters to scan for hot spots in the work.] [For torch applications,

provide and utilize a minimum of one calibrated thermal imaging camera, minimum 160x120 thermal IR resolution per torch capable of detecting infrared (IR) spectrum heat emission that could indicate a potential fire during the fire watch to verify cool, safe and non-combustible conditions exist. Provide a minimum duration fire watch of two hours conducted by personnel properly trained in the use of the camera to survey the underside of the roof deck, attic, and plenum spaces (where possible) and the topside of possible smoldering elements. Camera must have a manufacturer's certificate of calibration, and the use of the camera must be in compliance with Installation security policies.]

Do not torch in areas of poor or no visibility (curbs, corners, eaves, expansions joints, flashing, other voids and small penetrations) which could allow a torch flame to ignite combustible material(s) hidden from view or within the underside of the roof deck or building interior. Use cold finish applications in these areas whenever possible and per manufacturer's printed instructions, NRCA 4002, MRCA R&NW manual for "cold adhered" materials.

Do not leave the rooftop unattended during breaks in work during a work shift. Walk and scan all areas of application checking for hot spots, fumes, or smoldering, especially at wall and curb areas, prior to departure at the end of each work shift. Ensure any and all suspect conditions are eliminated prior to leaving the site each work shift.

#### 1.7.3 Open Flame Application (Torch) Equipment and Personnel Safety

Only NRCA/MRCA CERTA certified roofing applicators are allowed to operate any torching equipment. Verify that all such applicators maintain and are currently carrying a valid Certified Roofing Torch Applicator (CERTA) card.

Train all crew members in preventive measures for indirect and direct dangers and hazards associated with roofing work, which include, but are not limited to the following:

- a. Heat Stress: Wear light colored clothing, a hat for ultra-violet protection, and other eye protective devices. Drink sufficient quantities of non-alcoholic, non-caffeine liquids. Stage shifts for crew members to allow for breaks from heat and sun exposure without interfering with work progress.
- b. First Aid for Burns: Immediately call for an ambulance. Contact local Occupational Health Services (OHS).

All crew members must wear correct personal protective equipment (PPE), including, but not limited to the following items:

- a. Long-sleeved shirts buttoned at the collar and cuffs, made of non-flammable materials. Polyester materials are not allowed.
- b. Work boots covering ankles with rubber or composite soles.
- c. Long pants without cuffs to extend over the top of the work boots, be made of non-flammable materials. No polyester allowed.
- d. Heavy leather gloves and flame retardant gauntlets which must be worn during all handling of a torch, whether operating or not.
- e. OSHA and ANSI/ISEA Z87.1 approved face shields, goggles or safety

glasses to be worn during torching and any other applicable roofing functions.

- f. OSHA and ANSI approved hard hats.

#### 1.7.4 Wind Conditions

Use side shields with all torching operations when winds are occurring to prevent flame distortion of end burners. Use torch machine equipment with bottom shield plate to prevent flame spread on to roof deck and substrate. When high wind gusts are present, notify the safety officer and cease all use of torching equipment until wind conditions lower and authorization from the safety officer to proceed is received.

### ]1.8 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counter flashing, per **NRCA CONDET**, and are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. [Apply roofing immediately following application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.]

### 1.9 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty as required to comply with the specified requirements. Provide a manufacturer's warranty that has no dollar limit, covers full system water-tightness, and has a minimum duration of 20 years.

#### 1.9.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation in compliance with [**ASTM C1289**], and accessories necessary for a watertight roof system construction. Provide warranty directly to the Government and commence warranty effective date at time of Government's acceptance of the roof work. The warranty must state that:

- a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.
- b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.

- c. Upon completion of installation, and acceptance by the [Contracting Officer] [, Architect] [, Construction Manager] and Roofing System Engineer of Record, the manufacturer must supply the appropriate warranty to the Owner.
- d. Installer must submit a minimum two year warranty to the membrane manufacturer from the date of acceptance, with a copy to the [Contracting Officer] [, Architect] [, Construction Manager] and Roofing System Engineer of Record.

#### 1.9.2 Roofing System Installer Warranty

The roof system installer must warrant for a period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

#### 1.9.3 Continuance of Warranty

Repair or replacement work, ARMA 410BUR88, NRCA C3701 that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

#### 1.10 CONFORMANCE AND COMPATIBILITY

Provide the entire roofing and flashing system in accordance with specified and indicated requirements, including fire and wind resistance (ANSI/SPRI/FM 4435/ES-1) requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the NRCA Roofing and Waterproofing Manual, membrane manufacturer published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

#### 1.11 ELIMINATION, PREVENTION OF FALL HAZARDS

##### 1.11.1 Fall Protection

[\_\_\_\_\_]

#### PART 2 PRODUCTS

##### 2.1 MATERIALS

Coordinate with other specification sections related to the roof work. Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Protect materials provided from defects and make suitable for the service and climatic conditions of the installation.

##### 2.1.1 Energy [and Cool Roof] Performance

Install a roof system that meets an overall performance as specified on the drawings or by insulation specified in other sections. [ The roofing system will need to include a top surface finish that meets the criteria for Cool Roof Products. [ Provide emittance and reflectance percentages, solar reflectance index values, [and] slopes [\_\_\_\_], to meet sustainable third party certification requirements for [Heat Island Reduction](#).]

## 2.2 MODIFIED BITUMEN SHEETS AND FIBERGLASS FELT MATERIALS

Furnish a combination of specified materials that comprise the modified bitumen manufacturer's standard system of the number and type of plies specified. Provide materials suitable for the service and climatic conditions of the installation. Modified bitumen sheets must be watertight and visually free of pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Polymer modifier must comply with [ARMA PMBRG98](#) and be uniformly dispersed throughout the sheet. Edges of sheet must be straight and flat.

- [ a. Venting Base Sheet: [ASTM D4897/D4897M](#), Type II, [without] [with] perforations and as approved by the modified bitumen roof membrane manufacturer.
- ] [b. Fiberglass Felt Base Sheet: [ASTM D4601/D4601M](#), [ASTM D1668/D1668M](#) Type II, [without] [with] perforations and as approved by the modified bitumen roof membrane manufacturer.
- ] [ c. SBS Base Sheet: [[ASTM D6162/D6162M](#)] [or] [[ASTM D6164/D6164M](#)] [or] [[ASTM D6163/D6163M](#)], Type [I or] II, Grade S, minimum 80 mils thick.
- ] [d. SBS Interply Sheet: [[ASTM D6162/D6162M](#)] [or] [[ASTM D6164/D6164M](#)] [or] [[ASTM D6163/D6163M](#)], Type [I or] II, Grade S, minimum 80 mils thick.
- ] [ e. SBS Cap Sheet: [[ASTM D6162/D6162M](#)] [or] [[ASTM D6164/D6164M](#)] [or] [[ASTM D6163/D6163M](#)]; Type II, Grade [G] [S], minimum [ 145 mils] [\_\_\_\_] thick, and as required to provide specified fire safety rating.
- ] [ f. APP Base Sheet: [ASTM D6222/D6222M](#), Type I or II; or [ASTM D6223/D6223M](#); Grade [G] [S], minimum 140 mils thick.
- ] [ g. APP Cap Sheet: [ASTM D6222/D6222M](#), Type II; or [ASTM D6223/D6223M](#); Grade [G] [S], minimum 160 mils thick.

## ] 2.3 BASE FLASHING MEMBRANE

Membrane manufacturer's standard, minimum two-ply modified bitumen membrane flashing system compatible with the roof membrane specified and as recommended in membrane manufacturer's published literature. Provide flashing membranes that meet or exceed the properties of the material standards specified for the modified bitumen [base] [, interply] and cap sheet, except that flashing membrane thickness must be as recommended by the membrane manufacturer. [ Provide metal clad flashing membrane that complies with [ASTM D6298](#)].

## [ 2.4 ASPHALT

ASTM D312/D312M, Type III or IV, in accordance with modified bitumen membrane manufacturer requirements and compatible with the slope conditions of the installation.

] [2.5 COLD-APPLIED MEMBRANE ADHESIVE

Membrane manufacturer's recommended [low volatile organic compound (VOC)] cold process adhesive for application of the membrane plies.

] [2.6 MEMBRANE SURFACING

Provide modified bitumen roof membrane cap sheet with factory-applied granule surfacing of [light][\_\_\_\_\_] color [as selected from membrane manufacturer's standard colors]. [ Provide modified bitumen membrane manufacturer's recommended field-applied protective coating of [white][light gray][\_\_\_\_\_] color. [Provide aluminized coating that complies with ASTM D2824/D2824M, Type I or III, as recommended by the modified bitumen roof membrane manufacturer].] [ Light colored, opaque water-worn gravel aggregate surfacing material conforming to ASTM D1863/D1863M, or other aggregate as recommended by the membrane manufacturer and approved by the Contracting Officer[, and applied in flood coat of hot asphalt].]

] 2.7 PRIMER

ASTM D41/D41M, or other primer compatible with the application and as approved in writing by the modified bitumen membrane manufacturer.

2.8 MODIFIED BITUMEN ROOF CEMENT

ASTM D4586/D4586M, Type II for vertical surfaces, Type I for horizontal surfaces, compatible with the modified bitumen roof membrane and as recommended by the modified bitumen membrane manufacturer.

2.9 CANT AND TAPERED EDGE STRIPS

Provide standard cants and tapered edge strips of [perlite conforming to ASTM C728] [the same material as the roof insulation] [or when roof insulation material is not available, provide pressure preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the manufacturer.] [or wood fiber conforming to ASTM C208] treated with bituminous impregnation, sizing, or waxing and fabricated to provide maximum 45 degree change in direction of membrane. Cant strips must be minimum [ 1-1/2 inch thick and provide for minimum 5 inch face and 3-1/2 inch vertical height when installed at 45 degree face angle] [ 4 inch vertical height with 45 degree cant angle], except where clearance restricts height to lesser dimension. Taper edge strips at a rate of one to 1-1/2 inch per foot to a minimum of 1/8 inch of thickness. Provide kiln-dried preservative-treated wood cants, in compliance with requirements of Section 06 10 00 ROUGH CARPENTRY at base of wood nailers set on edge and wood curbing and where otherwise indicated.

2.10 FASTENERS AND PLATES

Provide coated, corrosion-resistant fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470 and FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified. For fastening of membrane or felts to wood materials, provide fasteners driven through 1 inch diameter

metal discs, or one piece composite fasteners with heads not less than 1 inch in diameter or 1 inch square with rounded or 45 degree tapered corners.

#### 2.10.1 Masonry or Concrete Walls and Vertical Surfaces

Use hardened steel nails or screws with flat heads, diamond shaped points, and mechanically deformed shanks not less than 1 inch long for securing felts, modified bitumen sheets, metal items, and accessories to masonry or concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing by the Contracting Officer.

#### 2.10.2 Metal Plates

Provide flat corrosion-resistant round stress plates as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470; not less than 2 inch in diameter. Form discs to prevent dishing or cupping.

### [2.11 PRE-MANUFACTURED ACCESSORIES

Pre-manufactured accessories must be manufacturer's standard for intended purpose, [ comply with applicable specification section,] compatible with the membrane roof system and approved for use by the modified bitumen membrane manufacturer.

#### [2.11.1 Pre-fabricated Curbs

Provide [\_\_\_\_\_] gauge [G90 galvanized] [AZ55 galvalume] [\_\_\_\_\_] curbs with minimum 4 inch flange for attachment to roof nailers. Curbs must be minimum height of 10 inch above the finished roof membrane surface.

#### ] [2.11.2 Elevated Metal [Walkways] [and] [Platforms]

As specified in Section [ 05 50 13 MISCELLANEOUS METAL FABRICATIONS] [ 05 51 33 METAL LADDERS] [ 05 52 00 METAL RAILINGS] [ 05 51 00 METAL STAIRS].

### ] [2.12 WALKPADS

Provide roof walkpads that are polyester reinforced, granule-surfaced modified bitumen membrane material, minimum [\_\_\_\_\_] [197] mils thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Panels must not exceed 4 foot in length. Other walkpad materials require approval of the Contracting Officer prior to installation.

#### ] [2.13 PAVER BLOCKS

Precast concrete, minimum 1-1/2 inch thick, minimum 18 inch square for walkways and minimum 6 inch by 12 inch for use in supporting surface bearing components but extending not less than 2 inch beyond all sides of surface bearing bases. Install walkpad material under all paver blocks.

#### ] [2.14 ROOF INSULATION BELOW MODIFIED BITUMEN MEMBRANE SYSTEM

Provide insulation compatible with the roof membrane, approved by the membrane manufacturer and meeting all the requirements of [ASTM C552] [ASTM C578] [ASTM C726] as specified in Section 07 22 00 ROOF AND DECK INSULATION.



## ]2.15 MEMBRANE LINER

Provide self-adhering modified bitumen underlayment conforming to ASTM D1970/D1970M, EPDM membrane liner conforming to ASTM D4637/D4637M, or other waterproof membrane liner material as approved by the Contracting Officer.

## [2.16 TOP COATING

Provide a top coating product that is Energy Star labeled and is produced and compatible with the roof material of this specification. Provide data identifying Energy Star label for top coating product. Install to the manufacturer's written installation methods. Provide written confirmation that installation of a top coat will not modify or void the required roof warranty.

## ]2.17 PHOTOVOLTAIC (PV) SYSTEMS - RACK MOUNTED SYSTEMS

Adhere to the following guidelines:

- a. Building Owners Guide to Roof-mounted PV Systems, published by NRCA.
- b. Guidelines for Roof-Mounted PV Systems, published by NRCA.

## PART 3 EXECUTION

## 3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

- a. Do not install items that show visual evidence of biological growth.
- b. [Drains,] [curbs,] [cants,] [control joints,] [expansion joints,] [perimeter walls,] [roof penetrating components,] [and] [equipment supports] are in place.
- c. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.
- d. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 foot when checked with a 10 foot straight edge placed anywhere on the substrate.
- e. Substrate is sloped as indicated to provide positive drainage.
- f. Walls and vertical surfaces are constructed to receive counter flashing, and will permit mechanical fastening of the base flashing materials.
- g. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inch above finished roofing surface.
- h. Protect all combustible materials and surfaces which may contain concealed combustible or flammable materials. All fire extinguishing equipment has been placed as specified.

- i. Verify all Fire Watch personnel assignments.
- j. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. [ Embedded nailers are flush with deck surfaces. ] [ Surface-applied nailers are the same thickness as the roof insulation. ]
- k. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than 3-1/2 inch.
- [ l. Venting is provided in accordance with the following:
  - [ (1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.
  - ] [ (2) Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.
- ] m. Exposed nail heads in wood substrates are properly set. Warped and split [boards] [sheets] have been replaced. There are no cracks or end joints 1/4 inch in width or greater. Knot holes are covered with sheet metal and nailed in place. [Wood] [Plywood] decks are covered with rosin paper or unsaturated felt prior to base sheet or roof membrane application. [ Joints in plywood substrates are taped or otherwise sealed to prevent air leakage from the underside. ]
- [ n. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 1/4 inch in width. Insulation is being roofed over on the same day the insulation is installed.
- ] o. Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph FIELD QUALITY CONTROL have been met.
- ] p. Joints between precast concrete deck units are grouted, leveled, and stripped in with felt or bituminous stripping membrane set in bituminous cement prior to applying other roofing materials over the area.
- ] q. Roof deck and framing are sloped as indicated to provide positive drainage.

### 3.2 PREPARATION

#### 3.2.1 Protection of Property

##### 3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoists[, tankers][, and kettles] prior to starting the work. Lap protective coverings not less than 6 inch, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

##### [3.2.1.2 Bitumen Stops

Provide felt bitumen stops or other means to prevent bitumen drippage at roof edges, openings, and vertical projections before hot mopped application of the roofing membrane.

] [3.2.2 Equipment

[3.2.2.1 Mechanical Application Devices

Mount mechanical application devices on pneumatic-tired wheels. Use devices designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

] [3.2.2.2 Flame-Heated Equipment

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

] [3.2.2.3 Open Flame Application Equipment

Utilize [torches](#) and other open flame equipment specifically designated for use in application of modified bitumen materials and approved by the modified bitumen sheet manufacturer. Open flame equipment must not be ignited (burning) when left unattended. Provide and maintain a fire extinguisher adjacent to open flame equipment on the roof. Specific requirements for fire watches and burn permits exist. These requirements will be reviewed at the prerooting conference.

] 3.2.2.4 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

] [3.2.3 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Utilize kettles with visible working thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus [1.8 degrees F](#), to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

[3.2.3.1 [Temperature Limitations for Asphalt](#)

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its finished blowing temperature (FBT). Do not heat asphalt between [500 and 525 degrees F](#) for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed membrane sheets when temperature of asphalt is within plus or minus [25 degrees F](#) of the equiviscous temperature (EVT) but not less than [400 degrees F](#). Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP,

FBT, and EVT of the asphalt used.

#### ]]3.2.4 Priming of Surfaces

Prime all surfaces to be in contact with adhered membrane materials. Apply primer at the rate of 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions to promote adhesion of membrane materials. Allow primer to dry prior to application of membrane materials to primed surface. Avoid flammable primer material conditions in torch applied membrane applications.

##### 3.2.4.1 Priming of Concrete and Masonry Surfaces

After surface dryness requirements have been met, coat concrete and masonry surfaces which are to receive membrane materials uniformly with primer.

##### 3.2.4.2 Priming of Metal Surfaces

Prime flanges of metal components to be embedded into the roof system prior to setting in bituminous materials or stripping into roofing system.

##### 3.2.5 Membrane Preparation

Unroll modified bitumen membrane materials and allow to relax a minimum of 30 minutes prior to installation. In cold weather, adhere to membrane manufacturer's additional recommendations for pre-installation membrane handling and preparation. Inspect for damage, pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Edges of seams must be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles. Discard damaged or defective materials.

##### 3.2.6 Substrate Preparation

Apply membrane to clean, dry surfaces only. Do not apply membrane to surfaces that have been wet by rain or frozen precipitation within the previous 12 hours. Provide cleaning and artificial drying with heated blowers or torches as necessary to ensure clean, dry surface prior to membrane application. Torches may not be used to ensure clean, dry surfaces prior to membrane applications if the roof deck or materials used in the installation of the roofing system are combustible.

#### 3.3 APPLICATION

Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer. Keep roofing materials dry before and during application. Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. [Provide temporary roofing and flashing as specified herein prior to application of permanent roofing system.]

##### 3.3.1 Phased Membrane Construction

Phased application of membrane plies is prohibited unless otherwise approved by the Contracting Officer and supported by the membrane manufacturer's written application instructions. If cap sheet installation is delayed, thoroughly clean the applied membrane material surface and dry immediately prior to cap sheet installation. Priming of

the applied membrane surface may be required at the discretion of the Contracting Officer prior to cap sheet installation.

### 3.3.2 Temporary Roofing and Flashing

Provide watertight temporary roofing and flashing where considerable work by other trades, such as installing [cooling towers,] [antennas,] [pipes,] [ducts,] [\_\_\_\_\_,] is to be performed on the roof or where construction scheduling or weather conditions require protection of the building's interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

#### [3.3.2.1 Removal

Completely remove temporary roofing and flashing before continuing with application of the permanent roofing system.

#### ]3.3.3 Application Method

##### [3.3.3.1 Hot Asphalt Application of Modified Bitumen Membrane

Apply membrane immediately following application of hot asphalt. Apply hot asphalt within 6 foot of roll. Do not work ahead with asphalt. Asphalt must be completely fluid, with mop temperatures within the asphalt's EVT range, but not less than 400 degrees F, at the instant membrane comes into contact with asphalt. Apply bitumen between layers to provide full, continuous, uniform coverage and complete contact of hot asphalt with the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly apply uniform positive pressure by squeegee, roll, or broom to ensure full adhesion and lap seal, eliminate trapped air and to provide tight, smooth laminations. Avoid excessive extrusion of asphalt at lap areas. Control asphalt bleed out to approximately 1 inch maximum.

##### ]3.3.3.2 Torch Applied [Heat Welded] Modified Bitumen Membrane [Flashing]

[ Base flashing membrane may be torch applied.] Ensure substrate membrane surfaces are warmed[ either] naturally[ or by torch] during the installation. Apply heat evenly to underside of roll membrane being installed and exposed side lap area of previously installed sheet. Provide for slight, uniform flow of bitumen in front of roll and full width of roll as the material is being rolled or set into place. Apply uniform positive pressure to ensure membrane is fully adhered and all laps are sealed. Prior to forming lap over granulated surfaces, embed granules of the receiving sheet by heating and troweling-in the granules to form a uniform black compound surface. [Roll all lap areas with a weighted roller immediately after forming lap. Provide for visual bleed out of compound in lap areas.][ Avoid overheating the membrane or burning through to membrane reinforcement. Inspect and ensure all lap areas are fully sealed.

##### ] [3.3.3.3 Cold Adhesive Applied Modified Bitumen Membrane

Apply cold adhesive with airless sprayer or 1/4 inch saw-toothed rubber squeegee to prepared surfaces in accordance with membrane manufacturer's application instructions. Fully cover substrate with adhesive. Roll or lay membrane in adhesive in accordance with manufacturer's recommendations and within the time limitations of adhesive application. Broom the membrane to ensure full contact with adhesive. Seal laps with adhesive or

by heat fusing with hot air welder as required by membrane manufacturer. Minimize traffic on installed membrane during the adhesive cure and set time.

#### ] 3.3.4 Ventilating Base Sheets

Apply ventilating base sheets with 3 inch side laps and 6 inch end laps in accordance with manufacturer's printed application instructions for substrate [and wind uplift conditions ]specified. [Provide mechanical attachments as required for wind resistance specified and to include increased frequency of attachment at corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate.][ Top mop perforated sheet with a full, continuous mopping of hot asphalt.]

#### ] 3.3.5 [Fiberglass Felt][Modified Bitumen] Base Sheet

[Fully adhere [spot adhere] base sheets in accordance with membrane manufacturer's printed instructions.] [Spot adhere base sheets with hot asphalt applied in 12 inch diameter spots installed in two staggered rows, centered 12 inch in from edge of the base sheet.][ Apply cold adhesive with airless sprayer or a 1/4 inch saw-toothed rubber squeegee and at application rate recommended by the membrane manufacturer. Fully cover substrate with cold adhesive. Ensure laps areas of base sheet are fully sealed.] Roll and broom in the base sheet to ensure full contact with the [hot asphalt][adhesive] application.[ On nailable substrates, mechanically fasten base sheet in conformance with specified wind resistance requirements and membrane manufacturer's printed instructions, and to include increased fastening frequency in corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate. Where applicable, mechanically fasten base sheet in conjunction with insulation to the substrate, in accordance with membrane manufacturers printed instructions.] Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 2 inch unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 6 inch and staggered a minimum of 36 inch. Apply sheets [at right angles to the roof slope so that the direction of water flow is over and not against the laps] [parallel to the roof slope] [so that plies of sheets extend from eave line on one side of the barrel-type roof and 18 inch over the center line of the crown of the roof. Apply sheets on the other side in the same manner, resulting in twice the normal amount of roofing sheets and asphalt at the crown]. Extend base sheets approximately 2 inch above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim base sheet to a neat fit around vent pipes, roof drains, and other projections through the roof. Application must be free of ridges, wrinkles, and buckles.

#### 3.3.6 Modified Bitumen Membrane Application

Ensure proper sheet alignment prior to installation. [Apply membrane layers perpendicular to slope of roof in shingle fashion to shed water, including application on areas of tapered insulation that change slope direction.][Apply membrane layers parallel to slope of roof.] Bucking or backwater laps are prohibited. Fully adhere membrane sheets to underlying substrate materials. Provide minimum 3 inch side laps and minimum 6 inch end laps and as otherwise required by membrane manufacturer. Stagger end laps minimum 36 inch. Offset side laps between membrane layers a minimum of 12 inch. Offset end laps between membrane layers a minimum of 36 inch. Install all membrane layers the same workday, unless supported otherwise by roof membrane manufacturer application instructions and approved by the

Contracting Officer. Provide tight smooth laminations of each membrane layer without wrinkles, ridges, buckles, kinks, fishmouths, or voids. Ensure full membrane adhesion and full lap seals. Rework to seal any open laps prior to application of subsequent membrane layers. The completed membrane application must be free of surface abrasions, air pockets, blisters, ridges, wrinkles, buckles, kinks, fishmouths, voids, or open seams.

#### 3.3.6.1 Cap Sheet Installation

Underlying applied membrane must be inspected and repaired free of damage, holes, puncture, gouges, abrasions, and any other defects, and free of moisture, loose materials, debris, sediments, dust, and any other conditions required by the membrane manufacturer prior to cap sheet installation. Do not apply cap sheet if rain or frozen precipitation has occurred within the previous 24 hours. Align cap membrane and apply by the specified method with the proper side and end lap widths. [Set cap sheet in hot asphalt or torch apply as recommended by the modified bitumen membrane manufacturer when the roof deck and materials used in the installation of the roofing system are non-combustible.] Cut at a 45 degree angle across selvage edge of cap membrane to be overlapped in end lap areas prior to applying overlapping cap membrane. [Apply matching granules in any areas of [bitumen][adhesive] bleed out while the [asphalt is still hot][adhesive is still tacky].] Minimize traffic on newly installed cap sheet membrane.

#### [3.3.6.2 Backnailing of Cap Sheet

Unless otherwise recommended by the modified bitumen membrane manufacturer and approved by the Contracting Officer, provide minimum 3-1/2 inch wide nailing strips matching insulation thickness and applied perpendicular to roof slope for backnailing of roof membrane. Space nailing strips as recommended by the membrane manufacturer, but not exceeding 16 foot on center unless approved otherwise by the Contracting Officer. Coordinate the nailer installation with insulation requirements. Install the modified bitumen cap sheet to provide for end laps at nailer locations. Nail the modified bitumen cap sheet at the end lap area across the width of the sheet. Nail within 1 inch of each edge of the sheet and at 8 inch to 8-1/2 inch on center across the width of the sheet in a staggered fashion. Nails must have 1 inch diameter metal cap or be nailed through 1 inch diameter caps. Cover nails by overlapping adjacent upslope sheet at the end lap area.

#### ]3.3.7 Membrane Flashing

Apply two-ply modified bitumen strip flashing and sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, and where necessary to make the work watertight. Apply membrane flashing in accordance with the roof membrane manufacturers printed instructions and as specified. Cut at a 45 degree angle across terminating end lap area of cap membrane prior to applying adjacent overlapping cap membrane. Press flashing into place to ensure full adhesion and avoid bridging. Ensure full lap seal in all lap areas. Mechanically fasten top edge of modified bituminous base flashing 150 mm (6 inches) on center through minimum 1 inch diameter tin caps with fasteners of sufficient length to embed minimum one inch into attachment substrate. [Apply matching granules in any areas of [asphalt][adhesive] bleed out while the [asphalt is still hot][adhesive is still tacky].] Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base

flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components. Metal flashing per [SMACNA 1793](#) guidelines and standards is specified under Section [07 60 00 FLASHING AND SHEET METAL](#). Do not set metal flashing in hot asphalt.

#### 3.3.7.1 Membrane Strip Flashing

Set primed flanges of metal flashing in full bed of modified bituminous cement material and securely fasten through to attachment substrate. Strip-in with membrane flashing so that strip extends not less than [4 inch](#) beyond outer edge of flange. Where multiple membrane stripping plies are installed, extend each additional stripping ply minimum [4 inch](#) beyond edge of previous ply.

#### [3.3.7.2 Membrane Flashing at Roof Drain

Roof drains are specified in Section [22 00 00 PLUMBING, GENERAL PURPOSE](#). Flashing for roof drains, is specified in Section [07 60 00 FLASHING AND SHEET METAL](#). Extend membrane sheets to edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Securely clamp membrane sheets and metal roof drain flashing and strip flashing in the flashing clamping ring. Secure clamps so that sheets and metal flashing are free from wrinkles and folds. Trim stripping must be flush with inside of clamping ring.

#### ] [3.3.7.3 Pre-fabricated Curbs

Securely anchor prefabricated curbs to nailer or other base substrate and flash with modified bitumen membrane.

#### ] 3.3.7.4 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories are set on the membrane, adhere walkpad material to bottom of accessories prior to setting on roofing membrane. Install set-on accessories to permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

#### 3.3.7.5 Lightning Protection

Flash and attach lightning protection system components to the roof membrane in a manner acceptable to the roof membrane manufacturer.

#### 3.3.8 Roof Walkpads

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the modified bitumen sheet roofing manufacturer's printed instructions. Provide minimum [6 inch](#) separation between adjacent walkpads to accommodate drainage. Provide walkpad [or an additional layer of cap sheet] under precast concrete paver blocks to protect the roofing.

#### [3.3.9 Elevated Metal [Walkways] [and] [Platforms]

Install over completed roof system in accordance with [ Section [05 50 13 MISCELLANEOUS METAL FABRICATIONS](#)] [ Section [05 51 33 METAL LADDERS](#)] [ Section [05 52 00 METAL RAILINGS](#)] [ Section [05 51 00 METAL STAIRS](#)]. Provide for



protection of roof membrane by placing walkpad material, or other material approved by the Contracting Officer, at all surface bearing support locations.

#### ]3.3.10 Paver Blocks

Install paver blocks where indicated and as necessary to support surface bearing items traversing the roof area. Set paver block on a layer of walkpad [or cap sheet] applied over the completed roof membrane.

#### [3.3.11 Field Applied Surfacing

After completion of roof membrane and flashing installation, and correction of tears, gouges, and other deficiencies in the installed work, apply specified surfacing.

##### [3.3.11.1 Aggregate

Uniformly flood coat the surface with hot asphalt at a rate of approximate 60 pounds per square. While asphalt is still hot, apply gravel aggregate surfacing material at a rate of 400 pounds per square or 300 pounds per square for slag or other approved aggregate surfacing. Provide for full and uniform coverage of the roof surface. Solidly adhere approximately 50 percent of the aggregate in the asphalt.

##### ] [3.3.11.2 Coating Application

Apply surface coating materials to membrane and flashing in accordance with coating material manufacturer's recommendations.

#### ]3.3.12 Correction of Deficiencies

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

#### 3.3.13 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

#### 3.4 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

#### 3.5 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system from water intrusion.

##### [3.5.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of modified bitumen roofing system in an effective manner. [Seal off flutes in metal decking along the cutoff edge.] Remove

the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

#### ]3.5.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashing can be applied. Remove temporary flashing before applying permanent flashing.

#### 3.5.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

### 3.6 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

#### [3.6.1 Test for Surface Dryness

Before application of membrane sheets and starting work on the area to be roofed, perform test for surface dryness in accordance with the following:

- a. Foaming: When poured on the surface to which membrane materials are to be applied, one pint of asphalt when heated in the range of 350 to 400 degrees F, must not foam upon contact.
- b. Strippability: On cementitious substrate surfaces, after asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from the surface, do not consider the surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been tested by the method above and found dry.
- c. Prior to installing any roof system on a concrete deck, conduct a test per ASTM D4263. The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

#### ]3.6.2 Construction Monitoring

During progress of the roof work, make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

- a. Materials comply with the specified requirements.
- b. Materials are not installed in adverse weather conditions.

All materials are properly stored, handled and protected from moisture or other damages.

- c. Equipment is in working order. Metering devices are accurate.

- d. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

- (1) Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

- (2) The proper number, type, and spacing of fasteners are installed.

Membrane heating, hot mopping, or adhesive application is provided uniformly and as necessary to ensure full adhesion of roll materials. Asphalt is heated and applied within the specified temperature range.

The proper number and types of plies are installed, with the specified overlaps.

Applied membrane surface is inspected, cleaned, dry, and repaired as necessary prior to cap sheet installation.

- (3) Lap areas of all plies are completely sealed.

Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths, or other voids or delaminations.

Installer adheres to specified and detailed application parameters.

Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Temporary protection measures are in place at the end of each work shift.

#### [3.6.2.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three [\_\_\_\_\_] times [once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place.

[ Inspections must occur during the first 20 squares of membrane installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections must not exceed one for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer.] After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

#### ]3.6.3 Samples of Roofing

Take samples per [ASTM D5147/D5147M](#), sized 4-inch by 40-inch cut across width of modified bitumen sheets as directed by the Contracting Officer. Cut samples will be examined by the Contracting Officer for specified number of plies, proper lap width, complete lap seal, full uniform adhesive compound application and adhesion, full bond between plies, harmful foreign materials, presence of moisture, and wet insulation. Where cuts are not retained by the Contracting Officer or disposed, set cut strip back in cut

area in bed of modified bitumen cement. Repair area of cut with new minimum two-ply modified bitumen membrane patch.

#### 3.6.4 Roof Drain Test

After completing roofing, but prior to Government acceptance, perform the following test for watertight integrity. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

#### [3.7 INFRARED INSPECTION

[Eight][\_\_\_\_\_] months after completion of the roofing system, the Contractor must inspect the roof surface using infrared (IR) scanning as specified in [ASTM C1153](#). Where the IR inspection indicates moisture intrusion, replace wet insulation and damaged or deficient materials or construction in a manner to provide watertight construction and maintain the specified roof system warranties. [ Coordinate infrared inspections with building envelope commissioning activities.]

#### ]3.8 INSTRUCTIONS TO [GOVERNMENT] [CONTRACTOR] PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the modified bitumen membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

#### 3.9 INFORMATION CARD

For each roof, furnish a typewritten information card for facility Records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 0.039 inch thick aluminum card for exterior display. Card must be 8 1/2 by 11 inch minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --

## SECTION 07 53 23

## ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

05/12, CHG 2: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## ASTM INTERNATIONAL (ASTM)

ASTM D448 (2012; R 2017) Standard Classification for Sizes of Aggregate for Road and Bridge Construction

ASTM D4637/D4637M (2015) EPDM Sheet Used in Single-Ply Roof Membrane

ASTM D4811/D4811M (2016) Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing

ASTM D6369 (1999; R 2006) Design of Standard Flashing Details for EPDM Roof Membranes

ASTM E108 (2020a) Standard Test Methods for Fire Tests of Roof Coverings

## FM GLOBAL (FM)

FM 4470 (2016) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction

FM APP GUIDE (updated on-line) Approval Guide <http://www.approvalguide.com/>

## NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA RoofMan (2020) The NRCA Roofing Manual

## SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI RD-1 (2014) Performance Standard for Retrofit Drains

U.S. DEPARTMENT OF ENERGY (DOE)

**Energy Star** (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

UNDERWRITERS LABORATORIES (UL)

**UL 790** (2022) UL Standard for Safety Test Methods for Fire Tests of Roof Coverings

**UL RMSD** (2012) Roofing Materials and Systems Directory

## 1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM[S]

[Fully adhered] [Mechanically fastened] [Ballasted] [Combination fully adhered and mechanically fastened] EPDM roof membrane system applied over [insulation] [recovery board] [concrete roof deck] substrate.

[\_\_\_\_\_]: [Fully adhered] [Mechanically fastened] [Ballasted] [Combination fully adhered and mechanically fastened] EPDM roof membrane system applied over [insulation] [recovery board] [concrete roof deck] substrate.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Roof Plan Drawing

Wind Load Calculations

Boundaries of Enhanced Perimeter

Corner Attachments of Roof System Components

Location of Perimeter Half-Sheets

Spacing of Perimeter, Corner, and Infield Fasteners

Slopes and Drain Locations

### SD-03 Product Data

Cement

EPDM Sheet; G[, [\_\_\_\_\_]]

[ Heat Island Reduction; S

] [ **Energy Star** Label for Top Coating; S

] Seam Tape

Bonding Adhesive

Lap Splice Adhesive

Water Cutoff Mastic/Water Block

Lap Cleaner, Lap Sealant, and Edge Treatment

Flashings

Flashing Accessories

Flashing Tape

Fasteners and Plates

[ Ballast

] Roof Insulation

[ Protection Mat

] [ Pre-Manufactured Accessories

] Sample Warranty Certificate; G[, [\_\_\_\_]]

Submit all data required together with requirements of this section. Include a written acceptance by the roof membrane manufacturer of the insulation and other products and accessories to be provided. List products in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

#### SD-05 Design Data

Wind Uplift Calculations; G[, [\_\_\_\_]]

[ Engineering calculations validating the wind resistance of roof system.

#### ] SD-07 Certificates

##### Qualification of Manufacturer

Certify that the manufacturer of the roof membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer."

##### Qualification of Applicator

Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

Wind Uplift Resistance classification, as applicable; G[, [\_\_\_\_]]

Fire Resistance classification; G[, [\_\_\_\_]]

Submit the roof system assembly [wind uplift and] fire rating

classification listings.

#### SD-08 Manufacturer's Instructions

Application; G[, [\_\_\_\_\_]]

Application Method; G[, [\_\_\_\_\_]], including pattern and frequency of mechanical attachments required in the field of roof, corners, and perimeters to provide for the specified wind resistance

Membrane Flashing; G[, [\_\_\_\_\_]]

Seam Tape

Tape Seams / Lap Splices

Adhesive Seams / Lap Splices

Perimeter Attachment

Primer

Fasteners

[ Pavers

] [ Protection Mat

] [ Pre-Manufactured Accessories

] Cold Weather Installation; G[, [\_\_\_\_\_]]

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's printed instructions and the specified requirements.

#### SD-11 Closeout Submittals

Warranty

Information Card

Instructions To Government Personnel

Include copies of Safety Data Sheets (SDS) for maintenance/repair materials.

#### 1.3.1 Shop Drawings

Roof plan drawing depicting wind load calculations and boundaries of enhanced perimeter and corner attachments of roof system components, [ location of perimeter half-sheets] [, spacing of perimeter, corner, and infield fasteners,] as applicable. Include the project roof plan of each roof level and conditions indicated. Provide all slopes and drain locations.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Qualification of Manufacturer



EPDM sheet roofing membrane manufacturer must have at least [5] [\_\_\_\_\_] years experience in manufacturing EPDM roofing products.

#### 1.4.2 Qualification of Applicator

Roofing system applicator must be approved, authorized, or licensed in writing by the roof membrane manufacturer and must have a minimum of [three] [\_\_\_\_\_] years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator must supply the names, locations and client contact information of 5 projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

#### 1.4.3 Qualifications of Photovoltaics (PV) Rooftop Applicator

The PV rooftop applicator must be approved, authorized, or certified by a Roof Integrated Solar Energy (RISE) Certified Solar Roofing Professional (CSRFP), and comply with applicable codes, standards, and regulatory requirements to maintain the weatherproofing abilities of both the integrated roof system and photovoltaic system.

#### 1.4.4 Fire Resistance

Complete roof covering assembly must:

- a. Be Class A rated in accordance with **ASTM E108**, **FM 4470**, or **UL 790**; and
- b. Be listed as part of Fire-Classified roof deck construction in the **UL RMSD** or Class I roof deck construction in the **FM APP GUIDE**.

FM or UL approved components of the roof covering assembly must bear the appropriate FM or UL label.

#### 1.4.5 Wind Uplift Resistance

Provide a complete roof system assembly that is rated and installed to resist wind loads [indicated] [calculated in accordance with **ASCE 7-16**] and validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Do not install non-rated systems except as approved by the Contracting Officer. Submit licensed engineer's **wind uplift calculations** and substantiating data to validate any non-rated roof system. Base wind uplift measurements based on a design wind speed of [\_\_\_\_\_] mph in accordance with **ASCE 7-16** and other applicable building code requirements

#### 1.4.6 Preroofing Conference

After approval of submittals and before performing roofing [and insulation] system installation work, hold a preroofing conference to review the following:

- a. Drawings, specifications and submittals related to the roof work;
- b. Roof system components installation;
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the

manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;

- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and
- e. Quality control plan for the roof system installation;
- f. Safety requirements.

Coordinate prerooting conference scheduling with the Contracting Officer. The conference must be attended by the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of roofing[ and insulation], flashing and sheet metal work, [[mechanical] [and] [electrical] work], other trades interfacing with the roof work, and representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

## 1.5 DELIVERY, STORAGE, AND HANDLING

### 1.5.1 Delivery

Deliver materials in their original, unopened containers or wrappings with labels intact and legible. Where materials are covered by a referenced specification number, the labels must bear the specification number, type, class, and shelf life expiration date where applicable. Deliver materials in sufficient quantity to allow continuity of work.

### 1.5.2 Storage

Store and protect materials from damage and weather in accordance with manufacturer's printed instructions, except as specified otherwise. Keep materials clean and dry. Store and maintain adhesives, sealants, primers and other liquid materials above 60 degrees F. Utilize insulated hot boxes or other enclosed warming devices in cold weather. Mark and remove damaged materials from the site. Use pallets to support and canvas tarpaulins to completely cover material materials stored outdoors. Do not use polyethylene as a covering. Locate materials temporarily stored on the roof in approved areas, and distribute the load to stay within the live load limits of the roof construction. Remove unused materials from the roof at the end of each days work.

### 1.5.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment so as not to damage materials or applied roofing. Do not use materials contaminated by exposure or moisture. Remove contaminated materials from the site. When hazardous materials are involved, adhere to the special precautions of the manufacturer. Adhesives may contain petroleum distillates and may be extremely flammable; prevent personnel from breathing vapors, and do not use near sparks or open flame.

## 1.6 ENVIRONMENTAL REQUIREMENTS

Do not install EPDM sheet roofing during high winds or inclement weather, or when there is ice, frost, moisture, or visible dampness on the substrate surface, or when condensation develops on surfaces during application. Unless recommended otherwise by the EPDM sheet manufacturer and approved by the Contracting Officer, do not install EPDM sheet when air temperature is below 40 degrees F or within 5 degrees F of the dewpoint. Follow manufacturer's printed instructions for installation during cold weather conditions.

#### 1.7 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counterflashing are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. [ Apply roofing immediately following application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.]

#### 1.8 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty as required to comply with the specified requirements. Provide a manufacturer's warranty that has no dollar limit, covers full system water-tightness and has a minimum duration of 20 years.

##### 1.8.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20 year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. Write the warranty directly to the Government and commence at time of Government's acceptance of the roof work. The warranty must state that:

- a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, splits, tears, cracks, delaminates, separates at the seams, shrinks to the point of bridging or tenting membrane at transitions, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship is the responsibility of the roof membrane manufacturer. The roof membrane manufacturer is responsible for all costs associated with the repair or replacement work.
- b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.

##### 1.8.2 Roofing System Installer Warranty

The roof system installer must warrant for a period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation,

accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

### 1.8.3 Continuance of Warranty

Approve repair or replacement work that becomes necessary within the warranty period and accomplish in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

## 1.9 CONFORMANCE AND COMPATIBILITY

Provide the entire roofing and flashing system in accordance with specified and indicated requirements, including fire and wind resistance requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the [NRCA RoofMan](#), membrane manufacturer published recommendations and details, [ASTM D6369](#), and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

## 1.10 ELIMINATION, PREVENTION OF FALL HAZARDS

### 1.10.1 Fall Protection

[\_\_\_\_\_]

## PART 2 PRODUCTS

### 2.1 MATERIALS

Coordinate with other specification sections related to the roof work. Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Protect materials provided from defects and make suitable for the service and climatic conditions of the installation.

#### 2.1.1 EPDM Sheet

Ethylene Propylene Diene Terpolymer (EPDM), [ASTM D4637/D4637M](#), [Type I, non-reinforced] [Type II, scrim or fabric reinforced] [Type III, fabric or fleece backed], [0.090 inch](#) nominal thickness for [mechanically fastened] [fully adhered] [loose-laid ballasted] [combined fully adhered and mechanically fastened] application. Provide membrane with minimum thickness not less than minus 10 percent of the specified thickness value. EPDM membrane thickness specified is exclusive of backing material on the EPDM membrane. Principal polymer used in manufacture of the membrane sheet must be greater than 95 percent EPDM. Width and length of sheet must be [as recommended by the manufacturer.] [maximum width attainable as recommended by the manufacturer to minimize field formed seams in the field of the roof.]

#### 2.1.2 Energy [and Cool Roof] Performance

Install a roof system that meets an overall performance as specified on the

drawings or by insulation specified in other sections. [ The roofing system will need to include a top surface finish that meets the criteria for Cool Roof Products. [ Provide emittance and reflectance percentages, solar reflectance index values, [and] slopes [\_\_\_\_], to meet sustainable third party certification requirements for [Heat Island Reduction](#).]]

### 2.1.3 [Seam Tape](#)

Double-sided synthetic rubber tape, minimum [0.03 inch](#) thick, minimum [3 inch](#) wide. Utilize seam tape as recommended by the manufacturer's printed data for forming watertight bond of EPDM sheet materials to each other for the application specified and conditions encountered. [6 inch](#) wide tape is required for seam seals along lines of mechanical attachment of membrane.

### 2.1.4 [Lap Splice Adhesive](#)

[Low volatile organic compound (VOC)] synthetic rubber adhesive as supplied by roof membrane manufacturer and recommended by the manufacturer's printed data for forming watertight bond of EPDM sheet membrane materials to each other [in areas of membrane flashing]. [Do not use splice adhesive to form membrane seams in field of roof or at standard base flashing conditions.]

### 2.1.5 [Bonding Adhesive](#)

[Low volatile organic compound (VOC)] [synthetic rubber] [\_\_\_\_] adhesive as supplied by roof membrane manufacturer and recommended by the manufacturer's printed data for bonding EPDM membrane materials to insulation, wood, metal, concrete or other substrate materials. Do not use bonding adhesive to bond membrane materials to each other.

### 2.1.6 [Lap Cleaner, Lap Sealant, and Edge Treatment](#)

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

### 2.1.7 [Water Cutoff Mastic/Water Block](#)

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

### 2.1.8 [Membrane Flashings and \[Flashing Accessories\]\(#\)](#)

Provide membrane flashing, including self-adhering membrane flashing, perimeter flashing, flashing around roof penetrations, and prefabricated pipe seals, that is minimum [0.045 inch](#) cured EPDM, as recommended by the roof membrane manufacturer or minimum [0.055 inch](#) thick uncured EPDM sheet in compliance with [ASTM D4811/D4811M](#), Type I. Use cured EPDM membrane to the maximum extent recommended by the roof membrane manufacturer. Limit uncured flashing material to reinforcing inside and outside corners and angle changes in plane of membrane, and to flash scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical.

#### 2.1.8.1 [Flashing Tape](#)

EPDM-backed synthetic rubber tape, minimum [6 inch](#) wide as supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

### 2.1.9 Membrane Fasteners and Plates

Coated, corrosion-resistant fasteners as recommended by the roof membrane manufacturer and meeting the requirements of FM 4470 and FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified. As supplied and warranted for the substrate type(s) by EPDM sheet manufacturer and recommended by EPDM sheet manufacturer's printed data.

#### 2.1.9.1 Stress Plates for Fasteners

Flat corrosion-resistant round stress plates as recommended by the roof membrane manufacturer's printed instructions and meeting the requirements of FM 4470; not less than 2 inch in diameter. Provide pre-formed discs to prevent dishing or cupping.

#### 2.1.9.2 Auxiliary Fasteners

Corrosion resistant screws, nails, or anchors suitable for intended attachment purpose and as recommended by the roof membrane manufacturer.

#### 2.1.9.3 Powder-Driven Fasteners

Powder-driven fasteners may be used only when approved in writing.

#### 2.1.9.4 Metal Disks

Provide flat metal disks of minimum 1 inch in diameter, made of nonferrous material compatible with the nails or fasteners.

### [2.1.10 Ballast

#### [2.1.10.1 Stone Ballast

Smooth, rounded, river-washed stone graded in accordance with ASTM D448, sizes 1, 2, 24, 3, and 4, nominal 3/4 inch to 1-1/2 diameter, except as recommended otherwise by the roof membrane manufacturer and approved by the Contracting Officer.

#### ] [2.1.10.2 Ballast Pavers

Provide weather resistant, precast [interlocking] concrete roof pavers [with drainage channels on the underside], and as recommended by the roof membrane manufacturer. Provide pavers of minimum 3000 psi 7500 psi compressive strength, weigh not less than 12 pounds per square foot 18 pounds per square foot [\_\_\_\_], not less than 1-1/4 inch 2 inch thick and nominal 24 inch [\_\_\_\_] in length and width and without sharp edges and projections. [Elevate pavers above the roof membrane surface with paver manufacturer's recommended [adjustable] pedestal system [to provide for level walking surface] as required by the roof membrane manufacturer.]

#### ] [2.1.11 Protection Mat / Slip Sheet

Minimum 4.5 ounce per square yard 6 ounce per square yard ultraviolet resistant polypropylene, non-woven, needle punched fabric for use as protection mat under ballast system and as recommended by the roof membrane manufacturer.

#### ] [2.1.12 Pre-Manufactured Accessories

Pre-manufactured accessories must be manufacturer's standard for intended purpose, [ comply with applicable specification section,] compatible with the membrane roof system and approved for use by the roof membrane manufacturer.

[2.1.12.1 Pre-fabricated Curbs

Provide [\_\_\_\_\_] gauge [G90 galvanized] [AZ55 galvalume] [\_\_\_\_\_] curbs with minimum 4 inch flange for attachment to roof nailers. Provide minimum height of 10 inch above the finished roof membrane surface.

]] [2.1.13 [Rubber Walkboards] [and] [Precast Concrete Paver Block Walkways]

Provide [either of] the following:

[2.1.13.1 Rubber Walkboards

Preformed reprocessed rubber, compatible with the EPDM sheet, 1/4 inch minimum thickness, and weighing not less than 1-1/2 pounds per square foot.

] [2.1.13.2 Precast Concrete Paver Block

Precast concrete blocks, 18 inch by 18 inch 24 inch by 24 inch, without sharp edges and projections, and weighing no more than 45 pounds 80 pounds each.

]] 2.1.14 Roof Insulation Below EPDM Sheet

Ensure insulation system and facer material is compatible with membrane application specified and as approved by the roof membrane manufacturer.

[2.1.15 Top Coating

Provide a top coating product that is Energy Star labeled and is produced and compatible with the roof material of this specification. Provide data identifying Energy Star label for top coating product. Install to the manufacturer's written installation methods. Provide written confirmation that installation of a top coat will not modify or void the required roof warranty.

] 2.1.16 Photovoltaic (PV) Systems - Rack Mounted Systems

Adhere to the following guidelines:

- a. Building Owners Guide to Roof-mounted PV Systems, published by NRCA.
- b. Guidelines for Roof-Mounted PV Systems, published by NRCA.

2.1.17 Wood Products

Do not allow fire retardant treated materials be in contact with EPDM membrane or EPDM accessory products, unless approved by the membrane manufacturer and the Contracting Officer.

2.1.18 Membrane Liner

[Self-adhering ]EPDM membrane liner conforming to ASTM D4637/D4637M, or other waterproof membrane liner material as approved by the roof membrane

manufacturer and the Contracting Officer.

## 2.2 FLASHING CEMENT

Provide a self-vulcanizing butyl compound flashing cement for splicing laps and for flashings workable at 20 degrees F. Obtain a recommendation for such flashing cement from the roofing membrane manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

- a. Do not install items that show visual evidence of biological growth.
- b. [Drins,] [curbs,] [control joints,] [expansion joints,] [perimeter walls,] [roof penetrating components,] [and] [equipment supports] are in place.
- c. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation.
- d. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 feet when checked with a 10 foot straight edge placed anywhere on the substrate.
- e. Substrate is sloped to provide positive drainage.
- f. Walls and vertical surfaces are constructed to receive counterflashing, and will permit mechanical fastening of the base flashing materials.
- g. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inch above finished roofing surface.
- h. Pressure-preservative treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. [Embedded nailers are flush with deck surfaces.] [Surface-applied nailers are the same thickness as the roof insulation.]
- i. Avoid contact of EPDM materials with fire retardant treated wood, except as approved by the roof membrane manufacturer and Contracting Officer.
- j. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than 3-1/2 inch.
- [ k. Venting is provided in accordance with the following:
  - [ (1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.
  - ] [ (2) Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.



- ] [ (3) Vapor pressure relief vents: Holes equal to the outside diameter of vents are provided through the insulation where vents are required. Space vents in accordance with membrane manufacturer's recommendations.
- ] ]1. Exposed nail heads in wood substrates are properly set. Warped and split [boards] [sheets] have been replaced. There are no cracks or end joints 1/4 inch in width or greater. [ Joints in plywood substrates are taped or otherwise sealed to prevent air leakage from the underside.]
- ] [m. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 1/4 inch in width. Insulation is being roofed over on the same day the insulation is installed.

### ]3.2 APPLICATION

Apply entire EPDM sheet utilizing [fully adhered] [loose-laid ballasted] [mechanically fastened] [combined fully adhered and mechanically fastened] application method[s]. Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer.

#### 3.2.1 Special Precautions

- a. Do not dilute coatings or sealants unless specifically recommended by the materials manufacturer's printed application instructions. Do not thin liquid materials with cleaners used for cleaning EPDM sheet.
- b. Keep liquids in airtight containers, and keep containers closed except when removing materials.
- c. Use liquid components, including adhesives, within their shelf life period. Store adhesives at 60 to 80 degrees F prior to use. Avoid excessive adhesive application and adhesive spills, as they can be destructive to some elastomeric sheets and insulations; follow adhesive manufacturer's printed application instructions. Mix and use liquid components in accordance with label directions and manufacturer's printed instructions.
- d. Provide clean, dry cloths or pads for applying membrane cleaners and cleaning of membrane
- e. Do not use heat guns or open flame to expedite drying of adhesives or primers.
- f. Require workmen and others who walk on the membrane to wear clean, soft-soled shoes to avoid damage to roofing materials.
- g. Do not use equipment with sharp edges which could puncture the EPDM sheet.
- h. Shut down air intakes and any related mechanical systems and seal open vents and air intakes when applying solvent-based materials in the area of the opening or intake. Coordinate shutdowns with the Contracting Officer.

#### 3.2.2 EPDM Sheet Roofing

Provide a watertight roof membrane sheet free of contaminants and defects that might affect serviceability. Provide a uniform, straight, and flat edge. Unroll EPDM sheet roofing in position without stretching membrane. Inspect for holes. Remove sections of EPDM sheet roofing that are damaged. Allow sheets to relax minimum 30 minutes before seaming. Lap sheets as specified, to shed water, and as recommended by the roof membrane manufacturer's published installation instructions for the application required but not less than 3 inch in any case.

### 3.2.3 Application Method

#### [3.2.3.1 Combined Fully Adhered and Mechanically Fastened Application

Install combined fully adhered and mechanically fastened roof membrane system in the manner specified and including seaming, perimeter and infield fastening and half sheets.

#### ] [3.2.3.2 Fully Adhered Membrane Application

Layout membrane and side lap adjoining sheets in accordance with membrane manufacturer's printed installation instructions. Allow for sufficient membrane to form proper membrane terminations. Remove dusting agents and dirt from membrane and substrate areas where bonding adhesives are to be applied. Apply specified adhesive evenly and continuously to substrate [and underside of sheets] at rates recommended by the roof membrane manufacturer's printed application instructions. When adhesive is spray applied, roll with a paint roller to ensure proper contact and coverage. Do not apply bonding adhesive to surfaces of membrane in seam or lap areas. Allow adhesive to flash off or dry to consistency prescribed by manufacturer before adhering sheets to the substrate. Roll each sheet into adhesive slowly and evenly to avoid wrinkles; broom or roll the membrane to remove air pockets and fishmouths and to ensure full, continuous bonding of sheet to substrate. Form field lap splices or seams as specified. Check all seams and ensure full lap seal. Apply lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

#### ] [3.2.3.3 Mechanically Fastened Membrane Application

Layout membrane and lap adjoining sheets in accordance with membrane manufacturer's printed instructions such that a minimum 3 inch [\_\_\_\_\_] seam width is maintained and seam width is as required by tested assembly meeting specified wind resistance requirements. Account for additional overlap required for placement of fasteners and plates or battens beyond the closed seam. Allow for sufficient membrane to form proper membrane terminations. Ensure membrane is free of wrinkles and ridges in the installation. Mechanically secure the membrane sheet with specified fasteners in the lap area. Space fasteners as required to provide the wind uplift resistance specified and in accordance with submitted fastener patterns for the field, corner, and perimeter roof areas. Set fasteners firm to plate or batten. Form field lap splices or seams as specified. Check all seams and ensure full lap seal. Apply lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

#### ] [3.2.3.4 Ballasted Membrane Application

Layout membrane and side lap adjoining sheets minimum 4 inch and according to membrane manufacturer's printed instructions. Allow for sufficient membrane to form proper membrane terminations. Ensure membrane is free of wrinkles and ridges in the installation. Form field lap splices or seams

as specified and of width required by the membrane manufacturer's installation instructions. Check seams to ensure continuous seal before proceeding with further work. Apply continuous lap sealant to all adhesive formed seams and all cut edges of reinforced membrane materials.

#### ]3.2.4 Tape Seams / Lap Splices

Field form seams, or lap splices, with seam tape in accordance with membrane manufacturer's printed instructions and as specified. Clean and prime mating surfaces in the seam area. After primer has dried or set in accordance with membrane manufacturer's instructions, apply seam tape to bottom membrane and roll with a 3 inch to 4 inch wide smooth silicone or steel hand roller, or other manufacturer approved rolling device, to ensure full contact and adhesion of tape to bottom membrane. Tape end laps must be minimum 1 inch. Roll top membrane into position to check for proper overlap and alignment. Remove release paper from top of seam tape and form seam splice. Ensure top membrane contact with seam tape as release paper is removed. Roll the closed seam with a smooth silicone or steel hand roller, rolling first across the width of the seam then along the entire length, being careful not to damage the membrane. Apply minimum 9 inch long strip of membrane-backed flashing tape over T-intersections of roof membrane. Roll tape to ensure full adhesion and seal over T-joint.

#### [3.2.5 Adhesive Seams / Lap Splices

Use only field-applied adhesive formed seams [in flashing areas] where approved by the membrane manufacturer and the Contracting Officer. Do not use adhesive formed seams for field of roof membrane seaming[, except as approved by the membrane manufacturer and the Contracting Officer]. Thoroughly and completely clean mating surfaces of materials throughout the lap area. Remove all dirt, dust, and contaminants and allow to dry.

Apply primer as recommended by the membrane manufacturer. Apply splice adhesive with a 3 inch to 4 inch wide, 1/2 inch thick, solvent-resistant brush in a smooth, even coat with long brush strokes. Bleed out brush marks. Do not apply adhesive in a circular motion. Simultaneously apply adhesive to both mating surfaces in an approximate 0.025 to 0.030 inch wet film thickness, or other thickness as recommended by the roof membrane manufacturer's printed instructions.

Allow the splice adhesive to set-up in accordance with membrane manufacturer's printed instructions. Perform manufacturer recommended field check to test for adhesive readiness prior to closing seam. Apply a 1/8 inch to 1/4 inch bead of in-seam sealant approximately 1/2 inch from the inside edge of the lower membrane sheet prior to closing the seam. Ensure the in-seam sealant does not extend onto the splice adhesive. Maintain the full adhered seam width required. Roll the top membrane onto the mating surface. Roll the seam area with a 2 inch to 3 inch wide, smooth silicone or steel hand roller. A minimum of 2 hours after joining sheets and when the lap edge is dry, clean the lap edge with membrane manufacturer's recommended cleaner and apply a 1/4 inch to 3/8 inch bead of lap sealant centered on the seam edge. With a feathering tool, immediately feather the lap sealant to completely cover the splice edge, leaving a mound of sealant over the seam edge. Apply lap sealant to all adhesive formed seams.

#### ]3.2.6 Perimeter Attachment

Adhesive bond or mechanically secure roof membrane sheet at roof perimeter

in a manner to comply with wind resistance requirements and in accordance with membrane manufacturer's printed application instructions. When adhesively bonding a mechanically fastened system in perimeter areas, the perimeter boundary of the adhesive bond must be the same as the boundary required for additional perimeter mechanical fastening to meet wind resistance requirements.

### 3.2.7 Securement at Base Tie-In Conditions

Mechanically fasten the roof membrane at penetrations, at base of curbs and walls, and at all locations where the membrane turns and angle greater than 4 degrees (1:12). Space fasteners a maximum of 12 inch on center, except where more frequent attachment is required to meet specified wind resistance or where recommended by the roof membrane manufacturer. Flash over fasteners with a fully adhered layer of material as recommended by the roof membrane manufacturer's printed data.

## 3.3 FLASHINGS

### 3.3.1 General

Provide flashings in the angles formed at walls and other vertical surfaces and where required to make the work watertight, except where metal flashings are indicated.

Provide a one-ply flashing membrane, as specified for the system used, and install immediately after the roofing membrane is placed and prior to finish coating where a finish coating is required. Flashings must be stepped where vertical surfaces abut sloped roof surfaces. Provide sheet metal reglet in which sheet metal cap flashings are installed of not more than 16 inch nor less than 8 inch above the roofing surfaces. Exposed joints and end laps of flashing membrane must be made and sealed in the manner required for roofing membrane.

### 3.3.2 Membrane Flashing

Install flashing and flashing accessories as the roof membrane is installed. Apply flashing to cleaned surfaces and as recommended by the roof membrane manufacturer and as specified. Utilize cured EPDM membrane flashing and prefabricated accessory flashings to the maximum extent recommended by the roof membrane manufacturer. Limit uncured flashing material to reinforcing inside and outside corners and angle changes in plane of membrane, and to flashing scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical. Extend base flashing not less than 8 inch above roofing surface and as necessary to provide for seaming overlap on roof membrane as recommended by the roof membrane manufacturer.

Seal flashing membrane for a minimum of 3 inch on each side of fastening device used to anchor roof membrane to nailers. Completely adhere flashing sheets in place. Seam flashing membrane in the same manner as roof membrane, except as otherwise recommended by the membrane manufacturer's printed instructions and approved by the Contracting Officer. Reinforce all corners and angle transitions by applying uncured membrane to the area in accordance with roof membrane manufacturer recommendations. Mechanically fasten top edge of base flashing with manufacturer recommended termination bar fastened at maximum 12 inch on center. Install sheet metal flashing over the termination bar in the completed work. Mechanically

fasten top edge of base flashing for all other terminations in a manner recommended by the roof membrane manufacturer. Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components.

#### [3.3.3 Flashing at Roof Drain

Provide a tapered insulation sump into the drain bowl area. Do not exceed tapered slope of 18 degrees for unreinforced membrane and 5 degrees for reinforced membrane. Provide tapered insulation with surface suitable for adhering membrane in the drain sump area. Avoid field seams running through or within 24 inch of roof drain, or as otherwise recommended by the roof membrane manufacturer. Adhere the membrane to the tapered in the drain sump area. Apply water block mastic and extend membrane sheets over edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Ensure membrane is free of wrinkles and folds in the drain area. Securely clamp membrane in the flashing clamping ring. Ensure membrane is cut to within 3/4 inch of inside rim of clamping ring to maintain drainage capacity. Do not cut back to bolt holes. Retrofit roof drains must conform to ANSI/SPRI RD-1.

#### ]3.3.4 PRE-FABRICATED CURBS

Securely anchor prefabricated curbs to nailer or other base substrate and flashed with EPDM membrane flashing materials.

#### 3.3.5 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories, or isolated paver block, are set on the membrane, adhere reinforced membrane or walkpad material, as recommended by the roof membrane manufacturer, to bottom of accessories prior to setting on roofing membrane. Install set-on accessories to permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

#### 3.3.6 Lightning Protection

Flash lightning protection system components or attach to the roof membrane in a manner acceptable to the roof membrane manufacturer.

#### [3.4 ROOF WALKPADS

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the roof membrane manufacturer's printed instructions. Provide minimum 6 inch separation between adjacent walkpads to accommodate drainage.

#### 3.4.1 Elevated Metal [Walkways] [and] [Platforms]

Provide for protection of roof membrane by placing reinforced membrane or walkpad material, or other material approved by the Contracting Officer, at all surface bearing support locations.

#### 3.4.2 Isolated Paver Blocks

Install paver blocks where indicated and as necessary to support surface bearing items traversing the roof area. Set paver block on a layer of reinforced membrane or walkpad applied over the completed roof membrane.

### 3.4.3 [Stone] [Paver] Ballast [Paver System]

Complete all membrane and membrane flashing work, including inspection and repair of all membrane and seams in the area of [ballast] [paver] application prior to applying [ballast] [paver] system. [Install protection mat over roof membrane in accordance with roof membrane manufacturer's recommendations. Provide minimum 3 inch side laps and 6 inch end laps. Turn mat up vertical surfaces to extend 50 mm 2 inch above ballast. Immediately after placement of protection mat,] [Install and level pedestal system in accordance with manufacturer's requirements and] apply [stone] [and] [paver] [ballast] [system.] [at the following coverage rates:

- a. [Pavers: ] [\_\_\_\_\_] pounds per square foot for perimeter and corner areas of roof.
- b. [\_\_\_\_\_] pounds per square foot for field of roof.

In no case apply ballast at a coverage rate less than 10 pounds per square foot or more than [\_\_\_\_\_] pounds per square foot.]

### ]3.5 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

### 3.6 CLEAN UP

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

### 3.7 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied membrane roofing system from water intrusion.

#### [3.7.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of the roof membrane system in an effective manner. [Seal off flutes in metal decking along the cutoff edge.] Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

#### ]3.7.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Remove temporary flashing before applying permanent flashing.

#### 3.7.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of

smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

### 3.8 FIELD QUALITY CONTROL

#### 3.8.1 Construction Monitoring

During progress of the roof work, Contractor must make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

- a. Equipment is in working order. Metering devices are accurate.
- b. Materials are not installed in adverse weather conditions.
- c. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

The proper number, type, and spacing of fasteners are installed.

Materials comply with the specified requirements.

All materials are properly stored, handled and protected from moisture or other damages. Liquid components are properly mixed prior to application.

Membrane is allowed to relax prior to seaming. Adhesives are applied uniformly to both mating surfaces and checked for proper set prior to bonding mating materials. Mechanical attachments are spaced as required[, including additional fastening of membrane in corner and perimeter areas as required.]

Membrane is properly overlapped.

Membrane seaming is as specified and seams are hand rolled to ensure full adhesion and bond width. [In-seam sealant is applied when adhesive seams are used in the field of the roof.] All seams are checked at the end of each work day.

Applied membrane is inspected and repaired as necessary prior to ballast installation.

- [ Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths.
- ] Installer adheres to specified and detailed application parameters.

Associated flashings and sheet metal are installed in a timely manner in accord with the specified requirements.

Ballast is within the specified weight range.

Temporary protection measures are in place at the end of each work

shift.

### [3.8.2 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three [\_\_\_\_\_] times [once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place. [Inspections must occur during the first 20 squares of membrane installation, at mid-point of the installation, and at substantial completion, at a minimum. Do not exceed additional inspections one for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer.] After each inspection, submit a report signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note overall quality of work, deficiencies and any other concerns, and recommended corrective action.

### ] [3.8.3 Roof Drain Test

After completing roofing but prior to Government acceptance, perform the following test for watertightness. Plug roof drains and fill with water to edge of drain sump for 8 hours. Retrofit roof drains must conform to ANSI/SPRI RD-1. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

### ] 3.9 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the roof membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

### 3.10 INFORMATION CARD

For each roof, furnish a typewritten information card for facility records and a photoengraved 0.032 inch thick aluminum card for exterior display. Card must be 8-1/2 by 11 inch minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --



## SECTION 07 60 00

## FLASHING AND SHEET METAL

05/17, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-6 2021; Addenda AS-BF 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASHRAE 189.1 (2014) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A308/A308M (2010) Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot Dip Process

ASTM A480/A480M (2020a) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B32 (2020) Standard Specification for Solder Metal

ASTM B69 (2021) Standard Specification for Rolled Zinc

ASTM B101 (2022) Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction

ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B370	(2022) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C1549	(2016) Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free
ASTM E408	(2013) Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
ASTM E971	(2011) Standard Practice for Calculation of Photometric Transmittance and Reflectance of Materials to Solar Radiation
ASTM E1918	(2016) Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
ASTM E1980	(2011) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition
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SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI RD-1	(2014) Performance Standard for Retrofit Drains
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U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star

(1992; R 2006) Energy Star Energy  
Efficiency Labeling System (FEMP)

## 1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Exposed Sheet Metal Coverings; G[, [\_\_\_\_]]

Gutters; G[, [\_\_\_\_]]

Downspouts; G[, [\_\_\_\_]]

Expansion Joints; G[, [\_\_\_\_]]

Gravel Stops and fascia; G[, [\_\_\_\_]]

Splash Pans; G[, [\_\_\_\_]]

Flashing for Roof Drains; G[, [\_\_\_\_]]

Base Flashing; G[, [\_\_\_\_]]

Counterflashing; G[, [\_\_\_\_]]

Flashing at Roof Penetrations and Equipment Supports; G[, [\_\_\_\_]]

Reglets; G[, [\_\_\_\_]]

Scuppers; G[, [\_\_\_\_]]

Copings; G[, [\_\_\_\_]]

Drip Edges; G[, [\_\_\_\_]]

Conductor Heads; G[, [\_\_\_\_]]

Open Valley Flashing; G[, [\_\_\_\_]]

Eave Flashing; G[, [\_\_\_\_\_]]

Recycled Content; S

#### SD-03 Product Data

Cool Roof Data; G[, [\_\_\_\_\_]]

#### SD-04 Samples

Finish Samples; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Instructions for Installation; G[, [\_\_\_\_\_]]

Quality Control Plan; G[, [\_\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Cleaning and Maintenance; G[, [\_\_\_\_\_]]

### 1.4 MISCELLANEOUS REQUIREMENTS

#### 1.4.1 Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

#### 1.4.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.

#### 1.4.3 Operation and Maintenance Data

Submit detailed [instructions for installation](#) and quality control during installation, [cleaning and maintenance](#), for each type of assembly indicated.

### 1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

## PART 2 PRODUCTS

### 2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

### 2.2 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by [SMACNA 1793](#) for a particular item, unless otherwise indicated. Provide materials, thicknesses, and configurations in accordance with [SMACNA 1793](#) for each material. Different items need not be of the same metal, except that [ if copper is selected for any exposed item, all exposed items must be copper, and that] contact between dissimilar metals must be avoided.

Furnish sheet metal items in [8 to 10 foot](#) lengths. Single pieces less than [8 feet](#) long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum [12 inch](#) legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

#### 2.2.1 [Exposed Sheet Metal](#) Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; [gravel stops and fascia](#); cap, valley, steeped, base, and eave flashings and related accessories.

#### 2.2.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

#### 2.2.3 Copper, Sheet and Strip

Provide in accordance with [ASTM B370](#), cold-rolled temper, H 00 (standard).

#### 2.2.4 Lead-Coated Copper Sheet

Provide in accordance with [ASTM B101](#).

#### 2.2.5 Lead Sheet

Provide in a minimum weight of [4 pounds per square foot](#).

#### 2.2.6 Steel Sheet, Zinc-Coated (Galvanized)

Provide in accordance with [ASTM A653/A653M](#).

#### 2.2.7 Zinc Sheet and Strip

Provide in accordance with [ASTM B69](#), Type I, a minimum of [0.024 inch](#) thick.

#### 2.2.8 Stainless Steel

Provide in accordance with [ASTM A480/A480M](#), Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

#### 2.2.9 Terne-Coated Steel

Provide in accordance with [ASTM A308/A308M](#), a minimum of 14 by 20 inch with minimum of 40 pound coating per double base box. [ASTM A308/A308M](#).

#### 2.2.10 Aluminum Alloy Sheet and Plate

Provide in accordance with [ASTM B209](#) [anodized [clear] [color [\_\_\_\_\_] [\_\_\_\_\_]]] form alloy, and temper appropriate for use. Provide material not less than [ 0.032-in] [ 0.065-in] in thickness.

##### [2.2.10.1 Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on [one side] [both sides] unless otherwise indicated.

- a. Gutters, downspouts, and hangers
- b. Gravel stops and fascia
- c. Flashing

##### ]2.2.11 Finishes

Provide exposed exterior sheet metal and aluminum with a baked on, factory applied color coating of polyvinylidene fluoride (PVF2) or approved equal fluorocarbon coating. Dry film thickness of coatings must be 0.8 to 1.3 mils. Color to be selected from [manufacturer's full range of "cool roof" color choices] [manufacturer's standard range of color choices] [manufacturer's full range of color choices] [as indicated on the Drawings]. Field applications of color coatings are prohibited and will be rejected.

#### 2.2.12 Cool Roof Finishes

Provide cool roof finish coatings and colors in accordance with one of the following methods of analysis:

##### 2.2.12.1 Energy Star Certification

Provide roof finishes having an initial solar reflectance of [0.65 for low slope roofs with a 2:12 pitch or less when tested in accordance with [ASTM E1918](#) and [ASTM E1980](#)] [0.25 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with [ASTM E971](#)] [\_\_\_\_\_] and an initial emissivity of [\_\_\_\_\_] when tested in accordance with [ASTM E408](#), or as certified by [Energy Star](#) for the particular product proposed. Certified [Energy Star](#) roof products are listed at <https://www.energystar.gov/productfinder/product/certified-roof-products/results>

##### 2.2.12.2 ASHRAE 189.1 Compliance

Provide roof finishes having a minimum initial Solar Reflectance Index of [78 for low slope roofs with a 2:12 pitch or less when tested in accordance with [ASTM E1918](#) and [ASTM E1980](#)] [29 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with [ASTM E971](#)] [\_\_\_\_\_] , to comply with [ASHRAE 189.1](#).

##### 2.2.12.3 ASHRAE 90.1 Compliance

Provide roof finishes having a minimum 3-year aged solar reflectance of

0.55 when tested in accordance with [ASTM C1549](#) or [ASTM E1918](#), and a minimum 3-year aged thermal emittance of 0.75 when tested in accordance with [ASTM E971](#) or [ASTM E408](#), or, a minimum 3-year aged Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in [ASTM E1980](#) using a convection coefficient of 2.1 BTU per h ft<sup>2</sup>, to comply with [ASHRAE 90.1 - IP](#).

#### 2.2.13 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

[ASTM B221](#).

#### 2.2.14 Solder

Provide in accordance with [ASTM B32](#), 95-5 tin-antimony.

#### 2.2.15 Reglets

##### 2.2.15.1 Polyvinyl Chloride Reglets

Provide in accordance with [ASTM D1784](#), Type II, Grade 1, Class 14333-D, [0.075 inch](#) minimum thickness.

##### 2.2.15.2 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of [1/4 inch](#) and a depth of [1-1/4 inch](#), as approved.

###### 2.2.15.2.1 Caulked Reglets

Provide with rounded edges, temporary reinforcing cores, and accessories as required for securing to adjacent construction. Provide built-up mitered corner pieces for inside and outside corners.

###### 2.2.15.2.2 Friction Reglets

Provide with flashing receiving slots not less than [5/8 inch](#) deep, [one inch](#) jointing tongues, and upper and lower anchoring flanges installed at [24 inch](#) maximum snap-lock type receiver.

#### 2.2.16 Scuppers

Line interiors of scupper openings with sheet metal. Provide a drip edge at bottom edges with returns of not less than [one inch](#) against the face of the outside wall at the top and sides. Provide the perimeter of the lining approximately [1/2 inch](#) less than the perimeter of the scupper.

#### 2.2.17 Conductor Heads

Provide conductor heads and screens in the same material as downspouts. Provide outlet tubes not less than [4 inches](#) long.

#### 2.2.18 Splash Pans

Provide splash pans where downspouts discharge onto roof surfaces and at locations indicated. Unless otherwise indicated, provide pans not less than [24 inches long by 18 inches wide](#) with metal ribs across bottoms of pans. Provide sides of pans with vertical baffles not less than [one inch](#) high in the front, and [4 inches](#) high in the back.

### 2.2.19 Copings

Unless otherwise indicated, provide copings in copper sheets, 8 or 10 feet long, joined by a 3/4 inch locked and soldered seam.

### 2.2.20 Bituminous Plastic Cement

Provide in accordance with ASTM D4586/D4586M, Type I.

### 2.2.21 Roofing Felt

Provide in accordance with ASTM D226/D226M [Type I] [Type II].

### 2.2.22 Asphalt Primer

Provide in accordance with ASTM D41/D41M.

### 2.2.23 Fasteners

Use the same metal as, or a metal compatible with the item fastened. [ Use stainless steel fasteners to fasten.] Confirm compatibility of fasteners and items to be fastened to avoid galvanic corrosion due to dissimilar materials.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Metal Roofing

##### [3.1.1.1 [Flat Copper,] [Zinc,] [Terne-coated Steel] Roofing

Before applying roofing, cover deck with rosin-sized roofing felt. Lap 2 inch at joints and secure in place with roofing nails. Using solder of equal parts tin and lead, solder slowly with well-heated irons to thoroughly heat sheet and completely sweat solder through full width of seam. [ Tin edges of copper to be soldered at least 3/4 inch before sheets are locked.] [ Use stainless nails in terne-coated steel]; [in copper, use solid copper or bronze roofing nails] [ in zinc, use zinc-coated roofing nails.] Where roof decks abut vertical surfaces, turn metal roofing up vertical surfaces about 8 inch where practicable; where vertical surfaces are covered with applied materials, turn up roofing behind applied materials. Use standing-seam method for roofs having rise of more than 3 inch per foot, and use flat-seam method when rise is 3 inch per foot or less. Walking not permitted directly on metal roofs; provide approved walkways.

##### ] [3.1.1.2 Standing-seam Method

Make standing seams parallel with slope of roof. Fabricate sheets into long lengths at shop by locking short dimensions together and thoroughly soldering joints thus formed. In applying metal, turn up one edge of course at each side seam at right angles 1.5 inch. Then install 2 by 3 inch cleats spaced 12 inches apart by fastening one end of each cleat to roof with two one inch long nails and folding roof end back over nail heads. Turn end adjoining turned-up side seam up over upstanding edge of course. Turn up adjoining edge of next course 1.75 inches and abutting upstanding edges locked, turned over, and flattened against one side of standing seam. Make standing seams straight, rounded neatly at the top edges, and



stand about **one inch** above roof deck. All sheets must be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern, as shown in **SMACNA 1793**.

#### ]3.1.1.3 Flat-seam Method

Lay metal so short dimension is parallel to gutter or eave lines and so water will flow over and not into seams. Make seams by turning edges of sheet **3/4 inch** and lock and solder together. If sheets are laid one at a time, secure to roof deck with cleats, using three cleats to each sheet, two on long side and one on short side. Use cleats **2 inches** wide, hooked over **3/4 inch** upturned edges of sheets, and nail to roof deck with two **one inch** long nails. Turn back roof end of cleat over nail heads before next sheet is applied. If desired, sheets may be made into long lengths at shop by locking short dimensions together and soldering seams thus formed. Turn long lengths **3/4 inch**, and secure each length to roof deck by cleats spaced **12 inches** apart. Mallet and solder seams after pans are in place. All sheets to be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern, as shown in **SMACNA 1793**.

#### ]3.1.2 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a **1/2 inch** hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of **SMACNA 1793**, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

#### 3.1.3 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of **18 inches**. Confine nailing of flashing to one edge only. Space nails evenly not over **3 inch** on center and approximately **1/2 inch** from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work. [ Secure flashing at one-half the normal interval to ensure a wind-resistant installation.]

#### 3.1.4 Cleats

Provide cleats for sheet metal **18 inches** and over in width. Space cleats evenly not over **12 inches** on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of **2 inches wide by 3 inches long** and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. [Where

the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. ]Pre-tin cleats for soldered seams.

### 3.1.5 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inches or less in thickness.

### 3.1.6 Seams

Straight and uniform in width and height with no solder showing on the face.

#### 3.1.6.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

#### 3.1.6.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

#### 3.1.6.3 Loose-Lock Expansion Seams

Not less than 3 inches wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8 inch thick bed.

#### 3.1.6.4 Standing Seams

Not less than one inch high, double locked without solder.

#### 3.1.6.5 Flat Seams

Make seams in the direction of the flow.

### 3.1.7 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pre-tin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

#### 3.1.7.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pre-tinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

### 3.1.8 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled

with sealant as recommended by the aluminum manufacturer.

#### 3.1.8.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to [AWS D1.2/D1.2M](#).

#### 3.1.8.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners [12 inches](#) maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than [2 inches](#) from the end of the overlapping sheet.

#### 3.1.9 Protection from Contact with Dissimilar Materials

##### 3.1.9.1 Copper or Copper-bearing Alloys

Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal, or separate the surfaces by means of moistureproof building felts.

##### 3.1.9.2 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint. [Aluminum may be used over concrete construction, provided that required reglets are of stainless steel and aluminum surface in contact with concrete or masonry is coated with bituminous paint or zinc chromate primer.]

##### 3.1.9.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

##### 3.1.9.4 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

#### 3.1.10 Expansion and Contraction

Provide expansion and contraction joints at not more than [32 foot](#) intervals for aluminum and at not more than [40 foot](#) intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascia by expansion and contraction joints spaced not more than [12 feet](#) apart.

##### 3.1.11 Base Flashing

[Lay the base flashings with each course of the roof covering, shingle fashion, where practicable, where sloped roofs abut chimneys, curbs, walls, or other vertical surfaces. ]Extend up vertical surfaces of the flashing not less than 8 inches and not less than 4 inches under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 6 inches. Overlap the flashing strips [or shingles] with the previously laid flashing not less than 3 inches. Fasten the strips [or shingles] at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 6 inches on center with [large headed aluminum roofing nails] [hex headed, galvanized shielded screws] a minimum of 2 inch lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of [chimneys,] [curbs,] [and similar] vertical surfaces extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 4.5 inches at the lower side of [dormer walls,] [chimneys,] [and similar] vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners. Do not use metal base flashing on built-up roofing.

### 3.1.12 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inches above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inches. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum [8 inches by 8 inches] [8 inches by 8 inches] or may be of the preformed single piece type. Provide end laps in counterflashings not less than 3 inches and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form flashings to the required shapes before installation. Factory form corners not less than 12 inches from the angle. Secure the flashings in the reglets with lead wedges and space not more than 18 inches apart; on [chimneys and] [stair/elevator towers] short runs, place wedges closer together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inches into the walls. Install counterflashing to provide a spring action against base flashing. [ Where bituminous base flashings are provided, extend down the counter flashing as close as practicable to the top of the cant strip. Factory form counter flashing to provide spring action against the base flashing.]

### 3.1.13 Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 1/4 inch and a minimum depth of 1-1/4 inch, when installed.

#### 3.1.13.1 Caulked Reglets

Wedge flashing in reglets with lead wedges every 18 inches, caulked full and solid with an approved compound.

#### 3.1.13.2 Friction Reglets

Install flashing snap lock receivers at 24 inches on center maximum. When flashing has been inserted the full depth of the slot, caulk the slot, lock [with wedges], and fill with sealant.

#### 3.1.14 Polyvinyl Chloride Reglets for Temporary Construction

Rigid polyvinyl chloride reglets may be provided in lieu of metal reglets for temporary construction.

#### 3.1.15 Gravel Stops and fascia

Prefabricate in the shapes and sizes indicated and in lengths not less than 8 feet. Extend flange at least 4 inches onto roofing. Provide prefabricated, mitered corners internal and external corners. Install gravel stops and fascia after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fascia on both sides with an asphalt primer. After primer has dried, set flange on roofing membrane and strip-in. Nail flange securely to wood nailer with large-head, barbed-shank roofing nails 1.5 inch long spaced not more than 3 inches on center, in two staggered rows.

##### 3.1.15.1 Edge Strip

Hook the lower edge of fascia at least 3/4 inch over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inches maximum on center. Where fastening is made to concrete or masonry, use screws spaced 12 inches on center driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 1/16 inch thick compatible spacer or washers.

##### 3.1.15.2 Joints

Leave open the section ends of gravel stops and fascia 1/4 inch and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 4 inches set laps in plastic cement. Face nailing will not be permitted. Install prefabricated aluminum gravel stops and fascia in accordance with the manufacturer's printed instructions and details.

#### 3.1.16 Metal Drip Edges

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inches and secure with compatible nails spaced not more than 10 inches on center along upper edge.

#### 3.1.17 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in

sections not less than 8 feet. Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inches minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on [ adjustable hangers spaced not more than 30 inches on center] [ as indicated] [ by continuous cleats] [ and] [ or] [ by cleats spaced not less than 36 inches apart]. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

### 3.1.18 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the [wood] [masonry] or [steel] substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

#### 3.1.18.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

### 3.1.19 Flashing for Roof Drains

Provide a 30 inches square sheet indicated. Taper insulation to drain from 24 inches out. Set flashing on finished felts in a full bed of asphalt roof cement, ASTM D4586/D4586M. Heavily coat the drain flashing ring with asphalt roof cement. Clamp the roof membrane, flashing sheet, and stripping felt in the drain clamping ring. Secure clamps so that felts and drain flashing are free of wrinkles and folds. Retrofit roof drains must conform to ANSI/SPRI RD-1.

### 3.1.20 Scuppers

Extend the scupper liner through and project outside of, the wall it penetrates to form a bottom drip edge against the face of the wall. Fold outside edges under 1/2 inch on all sides. Join the top and sides of the lining on the roof deck side to a closure flange by a locked and soldered joint. Join the bottom edge by a locked and soldered joint to the closure flange, where required, form with a ridge to act as a gravel stop around the scupper inlet. Provide surfaces to receive the scupper lining and coat with bituminous plastic cement.

### 3.1.21 Conductor Heads

Set the depth of the top opening equal to two-thirds of the width or the conductor head. Flat-lock solder seams. Where conductor heads are used in

conjunction with scuppers, set the conductor a minimum of 2 inches wider than the scupper. Attach conductor heads to the wall with masonry fasteners. Securely fasten screens to heads.

#### 3.1.22 Splash Pans

Install splash pans lapped with horizontal roof flanges not less than 4 inches wide to form a continuous surface. Bend the rear flange of the pan to contour of can't strip and extend up 6 inches under the side wall covering or to height of base flashing under counterflashing. Bed the pans and roof flanges in plastic bituminous cement and strip-flash as specified.

#### 3.1.23 Open Valley Flashing

Provide valley flashing free of longitudinal seams, of width sufficient to extend not less than 6 inches under the roof covering on each side. Provide a 1/2 inch fold on each side of the valley flashing. Lap the sheets not less than 6 inches in the direction of flow and secure to roofing construction with cleats attached to the fold on each side. Nail the tops of sheets to roof sheathing. Space the cleats not more than 12 inches on center. Provide exposed flashing not less than 4 inches in width at the top and increase one inch in width for each additional 8 feet in length. Where the slope of the valley is 4.5 inches or less per foot, or the intersecting roofs are on different slopes, provide an inverted V-joint, one inch high, along the centerline of the valley; and extend the edge of the valley sheets 8 inches under the roof covering on each side.

Valley flashing for asphalt shingle roofs is specified in Section 07 31 13 ASPHALT SHINGLES.

#### 3.1.24 Eave Flashing

One piece in width, applied in 8 to 10 foot lengths with expansion joints spaced as specified in paragraph EXPANSION AND CONTRACTION. Provide a 3/4 inch continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10 inches on center. Locate the upper edge of flashing not less than 18 inches from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with one inch flat locked joints with cleats that are 10 inches on center.

#### 3.1.25 Sheet Metal Covering on Flat, Sloped, or Curved Surfaces

Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 16 by 18 inches. Fasten sheets to sheathing with metal cleats. Lock seams and solder. Lock aluminum seams as recommended by aluminum manufacturer. Provide an underlayment of roofing felt for all sheet metal covering.

#### 3.1.26 Expansion Joints

Provide expansion joints for roofs, walls, and floors as [specified] [indicated]. Provide [expansion joints in continuous sheet metal at [40 foot intervals for copper and stainless steel] [and at 32 foot intervals for aluminum], [aluminum gravel stops and fascia which must have expansion joints at not more than 12 foot spacing]. Provide evenly spaced joints.

Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing]. Conform to the requirements of Table I.

#### 3.1.26.1 Roof Expansion Joints

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph COUNTERFLASHING, except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than **one inch** for flashing on one side of the expansion joint and be less than the width of the expansion joint plus **one inch** for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

#### 3.1.26.2 Floor and Wall Expansion Joints

Provide U-shape with extended flanges for expansion joints in concrete and masonry walls and in floor slabs.

#### 3.1.27 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rain hoods, power roof ventilators, and [\_\_\_\_\_] are specified in [\_\_\_\_\_].

#### 3.1.28 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail **3 inches** on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of **2 inches**. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a **4 inches** roof flange in bituminous plastic cement and nailed **3 inches** on center. Extend sleeve a minimum of **8 inches** above the roof deck and lapped a minimum of **3 inches** by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

#### 3.1.29 Stepped Flashing

Provide stepped flashing where sloping roofs surfaced with shingles abut vertical surfaces. Place separate pieces of base flashing in alternate shingle courses.

#### 3.1.30 Copings

Provide coping with locked and soldered seam. Terminate outer edges in edge strips. Install with sealed [lap joints] [cover plate joints] [standing seam joints] as indicated.



### 3.2 PAINTING

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products.

Field-paint sheet metal for separation of dissimilar materials.

#### [3.2.1 Aluminum Surfaces

Clean with solvent and apply one coat of zinc-molybdate primer and one coat of aluminum paint.

### ]3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

### 3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

#### [3.5 FIELD QUALITY CONTROL

Establish and maintain a [Quality Control Plan](#) for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification that specified material is provided and installed.
- c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

#### 3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square foot]	[Aluminum inch]	[Stainless Steel, inch]	[Terne-Coated Stainless Steel, inch]	[Zinc-Coated Steel, U.S. Std. Gage]
[Building Expansion Joints]					
[Cover]	16	.032	.015	.015	24
[Waterstop-bellows or flanged, U-type.]	16	-	.015	.015	-
[Covering on minor flat, pitched or curved surfaces]	20	.040	.018	.018	-
[Downspouts and leaders]	16	.032	.015	.015	24
[Downspout clips and anchors]	-	.040 clip .125 anchor	-	-	-
[Downspout straps, 2-inch]	48 (a)	.060	.050	-	-
[Conductor heads]	16	.032	.015	.015	-
[Scupper lining]	20	.032	.015	.015	-
[Strainers, wire diameter or gage]	No. 9 gage	.144 diameter	.109 diameter	-	
[Flashings:]					
[Base]	20	.040	.018	.018	24
[Cap (Counter-flashing)]	16	.032	.015	.015	26
[Eave]	16	-	.015	.015	24
[Spandrel beam]	10	-	.010	.010	-
[Bond barrier]	16	-	.015	.015	-
[Stepped]	16	.032	.015	.015	-
[Valley]	16	.032	.015	.015	-

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square foot]	[Aluminum inch]	[Stainless Steel, inch]	[Terne-Coated Stainless Steel, inch]	[Zinc-Coated Steel, U.S. Std. Gage]
[Roof drain]	16 (b)				
[Pipe vent sleeve (d)]					
[Coping]	16	-	-	-	-
[Gravel stops and fascia:]					
[Extrusions]	-	.075	-	-	-
[Sheets, corrugated]	16	.032	.015	.015	-
[Sheets, smooth]	20	.050	.018	.018	24
[Edge strip]	24	.050	.025	-	-
[Gutters:]					
[Gutter section]	16	.032	.015	.015	24
[Continuous cleat]	16	.032	.015	.015	24
[Hangers, dimensions]	1 inch by 1/8 inch (a)	1 inch by .080 inch (c)	1 inch by inch	-	-
[Joint Cover plates (See Table II)]	16	.032	.015	.015	24
[Reglets (c)]	10	-	.010	.010	-
[Splash pans]	16	.040	.018	.018	-
(a) Brass.					
(b) May be lead weighing 4 pounds per square foot.					
(c) May be polyvinyl chloride.					

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square foot]	[Aluminum inch]	[Stainless Steel, inch]	[Terne-Coated Stainless Steel, inch]	[Zinc-Coated Steel, U.S. Std. Gage]
(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph SINGLE PIPE VENTS for optional material.					

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated	1.25 inch single lock, standing	--
Flashings			
Base	One inch 3 inch lap for expansion joint	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum manufacturer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound.
Cap-in reglet	3 inch lap	3 inch lap	Seal groove with joint sealing compound.

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Reglets	Butt joint	--	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, cleated. One inch loose locked, sealed expansion joint, cleated.	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Stepped	3 inch lap	3 inch lap	--
Valley	6 inch lap cleated	6 inch lap cleated	--
Edge strip	Butt	Butt	--
Gravel stops:			
Extrusions	--	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.
Sheet, corrugated	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing beneath and a cover plate or a combination unit
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked riveted and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.
(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.			
(b) Seal Polyvinyl chloride reglet with manufacturer's recommended sealant.			

] -- End of Section --

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## SECTION 07 61 14.00 20

## STEEL STANDING SEAM ROOFING

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3 (2002; Suppl 2001-2004; R 2008)  
Cold-Formed Steel Design Manual Set

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A792/A792M (2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM A1008/A1008M (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM B117 (2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D226/D226M (2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D522/D522M (2017) Mandrel Bend Test of Attached Organic Coatings

ASTM D523 (2014; R 2018) Standard Test Method for Specular Gloss

ASTM D714 (2002; R 2017) Standard Test Method for

## Evaluating Degree of Blistering of Paints

ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1654	(2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM G152	(2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

## SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition
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## U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
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## 1.2 DEFINITIONS

## 1.2.1 Field-Formed Seam

Seams of panels so configured that when adjacent sheets are installed the seam is sealed utilizing mechanical or hand seamers. Crimped (45 degree



bend), roll formed (180 degree bend), double roll formed (2 - 180 degree bends), and roll and lock systems are types of field-formed seam systems.

#### 1.2.2 Snap Together Seam

Panels so configured that the male and female portions of the seam interlock through the application of foot pressure or tamping with a mallet. Snap-on cap configurations are a type of snap together system.

#### 1.2.3 Pre-Formed

Formed to the final, less field-formed seam, profile and configuration in the factory.

#### 1.2.4 Field-Formed

Formed to the final, less field-formed seam, profile and configuration at the site of work prior to installation.

#### 1.2.5 Roofing System

The roofing system is defined as the assembly of roofing components, including roofing panels, flashing, fasteners, and accessories which, when assembled properly result in a watertight installation.

#### 1.2.6 SSMRS

Standing Seam Metal Roof System (SSMRS) is abbreviation of the entire roof system specified herein with all components and parts coming from a single manufacturer's system.

### 1.3 SYSTEM DESCRIPTION

#### 1.3.1 Design Requirements

- a. Panels must be continuous lengths up to manufacturer's standard longest lengths, with no joints or seams, except where indicated or specified. Ribs of adjoining sheets must be in continuous contact from eave to ridge. Individual panels of snap together type systems must be removable for replacement of damaged material.
- b. There must be no exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners into steel must be stainless steel, zinc cast head, or cadmium plated steel screws inserted into predrilled holes. There must be a minimum of two fasteners per clip. Single fasteners will be allowed when supporting structural members are prepunched or predrilled.
- c. Snap together type systems must have a capillary break and a positive side lap locking device. Field-formed seam type systems must be mechanically locked closed by the manufacturer's locking tool. The seam must include a continuous factory applied sealant when required by the manufacturer to withstand the wind loads specified.
- d. Roof panel anchor clips must be concealed and designed to allow for longitudinal thermal movement of the panels, except where specific fixed points are indicated. Provide for lateral thermal movement in panel configuration or with clips designed for lateral and longitudinal movement.

### 1.3.2 Design Conditions

Design the system to resist positive and negative loads specified herein in accordance with the [AISI SG03-3](#). Panels must support walking loads without permanent distortion or telegraphing of the structural supports.

#### 1.3.2.1 Wind Uplift

Compute and apply the design uplift pressures for the roof system using a basic wind speed of [\_\_\_\_\_] miles per hour (mph). Roof system and attachments must resist the following wind loads, in pounds per square foot (psf):

	<u>Negative</u>
a. At eaves	[_____]
b. At rakes	[_____]
c. At ridge	[_____]
d. At building corners	[_____]
e. At central areas	[_____]

The design uplift force for each connection assembly must be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by the appropriate factor of safety, as follows:

- a. Single fastener in a connection: 3.0
- b. Two or more fasteners in each connection: 2.25

#### 1.3.2.2 Roof Live Loads

Loads must be applied on the horizontal projection of the roof structure. The minimum roof design live load must be 20 psf.

#### 1.3.2.3 Thermal Movement

System must be capable of withstanding thermal movement based on a temperature range of 10 degrees F below [\_\_\_\_\_] degrees F and [140 degrees F.] [180 degrees F.]

#### 1.3.2.4 Deflection

Panels must be capable of supporting design loads between unsupported spans with deflection of not greater than L/180 of the span.

### 1.3.3 Structural Performance

The structural performance test methods and requirements of the Standing Seam Roofing Systems (SSRS) must be in accordance with [ASTM E1592](#).

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Roofing; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Roofing Panels; G[, [\_\_\_\_\_]]

Energy Star Label for Steel Roofing Product; S

Recycled Content for Steel Roofing Product; S

[ Heat Island Reduction; S

] Attachment Clips

Closures

Accessories

Fasteners

Sealants

[ Insulation, including Joint Sealing Measures for Vapor Barrier Facing

] Sample Warranty Certificate; G[, [\_\_\_\_\_]]

Submit for materials to be provided. Submit data sufficient to indicate conformance to specified requirements.

#### SD-04 Samples

Roofing Panel

Submit a 12 inch long by full width section of typical panel.

[ For color selection, submit 2 by 4 inch metal samples in color, finish and texture [specified] [selected]. [When colors are not indicated, submit samples of not less than six different manufacturer's standard colors for selection.]

] Accessories

Submit each type of accessory item used in the project including, but not limited to each type of anchor clip, closure, fastener, and leg clamp.

Sealants

Intermediate Support Section

Submit full size samples of each intermediate support section, 12 inches long.

#### SD-05 Design Data

Design Calculations

#### SD-06 Test Reports

Field Inspection; G

Submit manufacturer's technical representative's field inspection reports as specified in paragraph MANUFACTURER'S FIELD INSPECTION.

Structural Performance Tests

Finish Tests

#### SD-07 Certificates

Manufacturer's Technical Representative's Qualifications

Statement of Installer's Qualifications

Submit documentation from roofing manufacturer proving the manufacturer's technical representative meets below specified requirements. Include name, address, telephone number, and experience record.

Submit documentation proving the installer is factory-trained, has the specified experience, and authorized by the manufacturer to install the products specified.

[ Coil Stock Compatibility; G[, [\_\_\_\_]]

Provide certification of coil compatibility with roll forming machinery to be used for forming panels without warping, waviness, and rippling not part of panel profile; to be done without damage, abrasion or marking of finish coating.

] SD-08 Manufacturer's Instructions

Installation Manual; G[, [\_\_\_\_]]

Submit manufacturers printed installation manual, instructions, and standard details.

#### SD-11 Closeout Submittals

Information Card

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

Warranty

## 1.5 DESIGN CALCULATIONS

Provide design calculations prepared by a professional engineer specializing in structural engineering verifying that system supplied and any additional framing meets design load criteria indicated. Coordinate calculations with manufacturer's test results. Include calculations for:

Wind load uplift design pressure at roof locations specified in paragraph WIND UPLIFT.

Clip spacing and allowable load per clip.

Fastening of clips to structure or intermediate supports.

Intermediate support spacing and framing and fastening to structure when required.

Allowable panel span at anchorage spacing indicated.

Safety factor used in design loading.

Governing code requirements or criteria.

Edge and termination details.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Preroofing Conference

After submittals are received and approved but before roofing [and insulation] work, including associated work, is preformed, the [Contracting Officer will] [Contractor must] hold a preroofing conference to review the following:

- a. The drawings and specifications
- b. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system
- c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing
- d. Safety requirements

The preroofing conference must be attended by the Contractor and personnel directly responsible for the roofing [and insulation] installation, [[mechanical] [and] [electrical] work], and the roofing manufacturer's technical representative. Conflicts among those attending the preroofing conference must be resolved and confirmed in writing before roofing work, including associated work, is begun. [Prepare written minutes of the preroofing conference and submit to the Contracting Officer.]

### 1.6.2 Manufacturer

The SSMRS must be the product of a metal roofing industry - recognized manufacturer who has been in the practice of manufacturing SSMRS for a period of not less than 5 years and who has been involved in at least 5

projects similar in size and complexity to this project.

#### 1.6.3 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative must be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative must be available to perform field inspections and attend meetings as required herein, and as requested by the Contracting Officer.

#### 1.6.4 Installer's Qualifications

The roofing system installer must be factory-trained, approved by the steel roofing system manufacturer to install the system, and must have a minimum of three years experience as an approved applicator with that manufacturer. The applicator must have applied five installations of similar size and scope as this project within the previous 3 years.

#### 1.6.5 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer; must be the latest design by the manufacturer; and must have been designed by the manufacturer to operate as a complete system for the intended use.

#### 1.6.6 Laboratory Tests For Panel Finish

The term "appearance of base metal" refers to the metal coating on steel. Panels must meet the following test requirements:

- a. Formability Test: When subjected to a 180 degree bend over a 1/8 inch diameter mandrel in accordance with ASTM D522/D522M, exterior coating film may show only slight microchecking and no loss of adhesion.
- b. Accelerated Weathering Test: Withstand a weathering test for a minimum of 2000 hours in accordance with ASTM G152 and ASTM G153, Method 1 without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with a penknife blade or similar instrument will be considered to indicate loss of adhesion.
- c. Chalking Resistance: After the 2000-hour weatherometer test, exterior coating may not chalk greater than No. 8 rating when measured in accordance with ASTM D4214 test procedures.
- d. Color Change Test:  
  
After the [2000] [\_\_\_\_]-hour weatherometer test, exterior coating color change must not exceed [2] [\_\_\_\_] NBS units when measured in accordance with ASTM D2244 test procedure.
- e. Salt Spray Test: Withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating must receive a rating of [8, few blisters] [10, no blisters] in field as determined by ASTM D714; and an average rating of [6, 1/8 inch] [7, 1/16 inch] failure at scribe, as determined by ASTM D1654.

Rating Schedule No. 1.

- f. Abrasion Resistance Test for Color Coating: When subjected to the falling sand test in accordance with [ASTM D968](#), coating system must withstand a minimum of [50] [100] [\_\_\_\_\_] liters of sand per mil thickness before appearance of base metal.
- g. Humidity Test: When subjected to a humidity cabinet test in accordance with [ASTM D2247](#) for 1000 hours, a scored panel must show no signs of blistering, cracking, creepage, or corrosion.
- h. Gloss Test: The gloss of the finish must be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with [ASTM D523](#).

[ i. Glare Resistance Test:

Surfaces of panels that will be exposed to the exterior must have a specular reflectance of not more than 10 when measured in accordance with [ASTM D523](#) at an angle of 85 degrees. Specular reflectance may be obtained with striations or embossing. Requirements specified under FORMABILITY TEST will be waived if necessary to conform to this requirement.

]1.6.7 Shop Drawing Requirements

Submit roofing drawings to supplement the instructions and diagrams. Include design and erection drawings containing an isometric view of the roof showing the design uplift pressures and dimensions of edge, ridge and corner zones; and show typical and special conditions including flashings, materials and thickness, dimensions, fixing lines, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, and spacing, terminations, penetrations, attachments, and provisions for thermal movement. Details of installation must be in accordance with the manufacturer's Standard Instructions and details or the [SMACNA 1793](#). Prior to submitting shop drawings, have drawings reviewed and approved by the manufacturer's technical engineering department.

1.7 [WARRANTY](#)

Furnish manufacturer's no-dollar-limit materials and workmanship warranty for the roofing system. The warranty period must be not less than 20 years from the date of Government acceptance of the work. The warranty must be issued directly to the Government. The warranty must provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or installed workmanship the repair or replacement of the defective materials and correction of the defective workmanship must be the responsibility of the roofing system manufacturer. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty must be performed within 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having the repairs performed by others and the cost billed to the manufacturer. In addition, provide a 2 year contractor installation warranty.

1.8 DELIVERY, STORAGE AND HANDLING

Deliver, store, and handle preformed panels, bulk roofing products and other manufactured items in a manner to prevent damage or deformation.

#### 1.8.1 Delivery

Provide adequate packaging to protect materials during shipment. Crated materials must not be uncrated until ready for use, except for inspection. Immediately upon arrival of materials at the jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with satisfactory material. If materials are wet, remove the moisture and re-stack and protect the panels until used.

#### 1.8.2 Storage

Stack materials on platforms or pallets and cover with tarpaulins or other suitable weathertight covering which prevents water trapping or condensation. Store materials so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.

#### 1.8.3 Handling

Handle material carefully to avoid damage to surfaces, edges and ends.

### PART 2 PRODUCTS

#### 2.1 ROOFING PANELS

Provide panels with interlocking ribs for securing adjacent sheets and with concealed clip fastening system for securing the roof covering to structural framing members. Fasteners must not penetrate the panels except at the ridge, eave, rakes, penetrations, and end laps. Backing plates and ends of panels at end laps must be predrilled or prepunched. Factory prepare ends of panels to be lapped by trimming part of seam, die-setting, or swaging ends of panels. Individual sheets must be sufficiently long to cover the entire length of any unbroken roof slope when such slope is 30 feet or less. Provide panels that extend over two or more spans when length of run exceeds 30 feet. Obtain Contracting Officer (KO) approval for sheets longer than 30 feet before submitting shop drawings. Sheets must provide not less than 12 inches of coverage (width) in place. Provide panels with a minimum corrugation height of [1.75] [2.25] [3.0] inches (nominal). Make provisions for expansion and contraction at either ridge or eave, consistent with the type of system to be used. Form panels from coil stock without warping, waviness or ripples not part of the panel profile, and free of damage to the finish coating system.

Provide steel roofing product that is Energy Star labeled. Provide data identifying Energy Star label for steel roofing product. [ Provide solar reflectance product with an initial solar reflectance greater than or equal to 0.25 and a solar reflectance greater than or equal to 0.15 three years after installation under normal conditions. ] [ Provide emittance and reflectance percentages, solar reflectance index values, [and] slopes [\_\_\_\_], to meet sustainable third party certification requirements for Heat Island Reduction. ]

##### 2.1.1 Material



Zinc-coated steel conforming to [ASTM A653/A653M](#), G90 coating designation or aluminum-zinc alloy coated steel conforming to [ASTM A792/A792M](#), AZ 55 coating. Provide material with a minimum thickness of 0.023 inch thick (24 gage) minimum except when mid field of roof is subject to design wind uplift pressures of 60 psf or greater, entire roof system must have a minimum thickness of 0.030 inch (22 gage). Steel roofing materials must contain a minimum of 30 percent total recycled content. Provide data identifying percentage of [recycled content for steel roofing product](#). [Prior to shipment, treat mill finish panels with a passivating chemical and oil to inhibit the formation of oxide corrosion products. Dry, retreat, and re-oil panels that have become wet during shipment or storage but have not started to oxidize.]

#### 2.1.2 Texture

[Stucco embossed.] [ Smooth.] [ Smooth with raised intermediate ribs for added stiffness.]

#### 2.1.3 Finish

[Unpainted] [Factory color finish].

##### [2.1.3.1 Factory Color Finish

Provide factory applied, thermally cured coating to exterior and interior of metal roof and wall panels and metal accessories. Provide exterior finish top coat of [70 percent resin polyvinylidene fluoride] [\_\_\_\_\_] with not less than [0.2 mil] [0.8 mil] [\_\_\_\_\_] dry film thickness. Provide exterior primer [standard with panel manufacturer] [\_\_\_\_\_] with not less than [0.2 mil] [0.8 mil] dry film thickness. Interior finish must consist of [0.2 mil] dry film thickness prime coat [0.5 mil] dry film thickness backer coat [the same coating and dry film thickness as the exterior coating] [\_\_\_\_\_] . Provide exterior [and interior ]coating meeting test requirements specified below. Tests must have been performed on the same factory finish and thickness provided. [ Provide clear factory edge coating on all factory cut or unfinished edges.]

#### ]2.2 INTERMEDIATE SUPPORTS

Fabricate panel subgirts, subpurlins, T-bars, Z-bars and tracks from galvanized steel conforming to [ASTM A653/A653M](#), G90, Grade D ( 16 gage and heavier), Grade A ( 18 gage and lighter); or steel conforming to [ASTM A36/A36M](#), [ASTM A1011/A1011M](#) , or [ASTM A1008/A1008M](#) prime painted with zinc-rich primer. Size, shape, thickness and capacity as required to meet the load[, insulation thickness] and deflection criteria specified.

#### 2.3 ATTACHMENT CLIPS

Fabricate clips from [ASTM A1011/A1011M](#), or [ASTM A1008/A1008M](#) steel hot-dip galvanized in accordance with [ASTM A653/A653M](#), G 90, or Series 300 stainless steel. Size, shape, thickness and capacity as required to meet the load, insulation thickness and deflection criteria specified.

#### 2.4 ACCESSORIES

Sheet metal flashings, [gutters,] [downspouts,] trim, moldings, closure strips, pre-formed crickets, caps, equipment curbs, and other similar sheet metal accessories used in conjunction with preformed metal panels must be

of the same material as used for the panels. Provide metal accessories with a factory color finish to match the roofing panels, except that such items which will be concealed after installation may be provided without the finish if they are stainless steel. Metal must be of a thickness not less than that used for the panels. Thermal spacer blocks and other thermal barriers at concealed clip fasteners must be as recommended by the manufacturer except that wood spacer blocks are not allowed.

#### 2.4.1 Closures

##### 2.4.1.1 Rib Closures

Corrosion resisting steel, closed-cell or solid-cell synthetic rubber, neoprene or polyvinyl chloride pre-molded to match configuration of rib opening. Material for closures must not absorb water.

##### 2.4.1.2 Ridge Closures

Metal-clad foam or metal closure with foam secondary closure matching panel configuration for installation on surface of roof panel between panel ribs at ridge and headwall roof panel flashing conditions and terminations. Foam material must not absorb water.

#### 2.4.2 Fasteners

Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Design the fastening system to withstand the design loads specified. Exposed fasteners must be gasketed or have gasketed washers on the exterior side of the covering to waterproof the penetration. Washer material must be compatible with the covering; have a minimum diameter of  $3/8$  inch for structural connections; and gasketed portion of fasteners or washers must be neoprene or other equally durable elastomeric material approximately  $1/8$  inch thick.

##### 2.4.2.1 Screws

Not smaller than No. 14 diameter if self-tapping type and not smaller than No. 12 diameter if self-drilling and self-tapping.

##### 2.4.2.2 Bolts

Not smaller than  $1/4$  inch diameter, shouldered or plain shank as required, with proper nuts.

##### 2.4.2.3 Automatic End-Welded Studs

Automatic end-welded studs must be shouldered type with a shank diameter of not smaller than  $3/16$  inch and cap or nut for holding covering against the shoulder.

##### 2.4.2.4 Explosive Driven Fasteners

Fasteners for use with explosive actuated tools must have a shank diameter of not smaller than  $0.145$  inch with a shank length of not smaller than  $1/2$  inch for fastening to steel and not smaller than  $1$  inch for fastening to concrete.

##### 2.4.2.5 Rivets

Blind rivets must be stainless steel with 1/8 inch nominal diameter shank. Rivets must be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems must have closed ends.

#### 2.4.3 Sealants

Elastomeric type containing no oil or asphalt. Exposed sealant must cure to a rubberlike consistency. Concealed sealant must be the non-hardening type. Seam sealant must be factory-applied, non-skinning, non-drying, and must conform to the roofing manufacturer's recommendations. Silicone-based sealants must not be used in contact with finished metal panels and components unless approved otherwise by the Contracting Officer.

#### 2.4.4 GASKETS AND INSULATING COMPOUNDS

Nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds must be nonrunning after drying.

### [2.5 THERMAL INSULATION

Flexible blanket, rigid, or semi-rigid faced with a flexible vapor retarder. Insulation and facing must have a flame-spread rating of 50 or less in accordance with ASTM E84. Vapor retarder facing must have a permeance rating of 0.05 perm or less. Provide a thermal resistance "R" value of [\_\_\_\_\_] or more. [Exposed insulation must have a white nondusting and nonshedding finish.] Facings [and finishes] must be factory-applied.

### ]2.6 UNDERLAYMENT FOR WOOD SUBSTRATES

ASTM D226/D226M, Type I perforated, covered by water-resistant rosin sized building paper.

### ]2.7 LINER PANELS

Fabricate liner panels of the same material as roof panels, and formed or patterned to prevent waviness and distortion. Liner panels must have a factory applied, one mil thick minimum painted coating on the inside face and a prime coat on the liner side.

## PART 3 EXECUTION

Do not install building construction materials that show visible evidence of biological growth.

### 3.1 EXAMINATION

Examine surfaces to receive standing seam metal roofing and flashing. Ensure that surfaces are plumb and true, clean, even, smooth, as dry and free from defects and projections which might affect the installation.

### 3.2 PROTECTION FROM CONTACT WITH DISSIMILAR MATERIALS

#### 3.2.1 Cementitious Materials

Paint metal surfaces which will be in contact with mortar, concrete, or other masonry materials with one coat of alkali-resistant coating such as heavy-bodied bituminous paint.

### 3.2.2 Contact with Wood

Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

## 3.3 INSTALLATION

Install in accordance with the approved manufacturer's erection instructions, shop drawings, and diagrams. Panels must be in full and firm contact with attachment clips. Where prefinished panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they must, after necessary repairs have been made with material of the same color as the weather coating, be approved before being installed. Seal completely openings through panels. Correct defects or errors in the materials. Replace materials which cannot be corrected in an approved manner with nondefective materials. Provide molded closure strips where indicated and where necessary to provide weathertight construction. Use shims as required to ensure attachment clip line is true. Use a spacing gage at each row of panels to ensure that panel width is not stretched or shortened. [ Provide one layer of asphalt-saturated felt placed perpendicular to roof slope, covered by one layer of rosin-sized building paper placed parallel to roof slope with side laps down slope and attached with roofing nails. Overlap side and end laps 3 inches, offset seams in building paper with seams in felt.]

### 3.3.1 Roof Panels

Apply roofing panels with the standing seams parallel to the slope of the roof. Provide roofing panels in longest practical lengths from ridge to eaves (top to eaves on shed roofs), with no transverse joints except at the junction of ventilators, curbs, skylights, chimneys, and similar openings. Install flashing to assure positive water drainage away from roof penetrations. Locate panel end laps such that fasteners do not engage supports or otherwise restrain the longitudinal thermal movement of panels. Form field-formed seam type system seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to the structure with concealed clips incorporated into panel seams. Clip attachment must allow roof to move independently of the structure, except at fixed points as indicated.

### [3.3.2 Insulation Installation

Install between covering and supporting members to present a neat appearance. Fold and staple [and tape] seams unless approved otherwise by the Contracting Officer.

#### 3.3.2.1 Rigid or Semi-Rigid Insulation

Install in areas where insulation is exposed to view. Fasten securely without loose joints or unsightly sags.

#### 3.3.2.2 Blanket Insulation

May be used in concealed locations. Lap facing at joints and fasten in a manner that will provide tight joints.

### ]3.3.3 Flashings

Provide flashing, related closures and accessories as indicated and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal the roof at the ridge, eaves and rakes, and projections through the roof. Place closure strips, flashing, and sealing material in an approved manner that will assure complete weathertightness. Details of installation which are not indicated must be in accordance with the [SMACNA 1793](#), panel manufacturer's approved printed instructions and details, or the approved shop drawings. Allow for expansion and contraction of flashing.

#### 3.3.4 Flashing Fasteners

Fastener spacings must be in accordance with the panel manufacturer's recommendations and as necessary to withstand the design loads indicated. Install fasteners in roof valleys as recommended by the manufacturer of the panels. Install fasteners in straight lines within a tolerance of [1/2 inch](#) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface and to a uniform depth to seat gasketed washers properly and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tape. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners must not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

#### 3.3.5 Rib and Ridge Closure/Closure Strips

Set closure/closure strips in joint sealant material and apply sealant to mating surfaces prior to adding panel.

### 3.4 PROTECTION OF APPLIED ROOFING

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction.

### 3.5 CLEANING

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks and damage to the finish coating.

### 3.6 MANUFACTURER'S [FIELD INSPECTION](#)

Manufacturer's technical representative must visit the site as necessary during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Manufacturer's technical representative must perform a field inspection during the first [20] [\_\_\_\_\_] squares of roof panel installation and at substantial completion prior to issuance of warranty, as a minimum, and as otherwise requested by the Contracting Officer. Additional inspections must not exceed one for [100] [\_\_\_\_\_] squares of total roof area with the exception

that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer. Each inspection visit must include a review of the entire installation to date. After each inspection, submit a report, signed by the manufacturer's technical representative, to the Contracting Officer noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify Contracting Officer a minimum of 2 working days prior to site visit by manufacturer's technical representative.

### 3.7 COMPLETED WORK

Completed work must be plumb and true without oil canning, dents, ripples, abrasion, rust, staining, or other damage detrimental to the performance or aesthetics of the completed roof assembly.

### 3.8 INFORMATION CARD

For each roof, provide a typewritten card, laminated in plastic and framed for interior display or a photoengraved 0.032 inch thick aluminum card for exterior display. Card to be 8 1/2 by 11 inches minimum and contain the information listed on Form 1 at end of this section. Install card near point of access to roof, or where indicated. Send a photostatic paper copy to [NAVFAC Washington, Building 2, Washington Navy Yard, Washington, DC 20374-2121] [LANTNAVFACENGCOM, Code 1613, 1510 Gilbert Street, Norfolk, VA 23511-2699] [NORTHNAVFACENGCOM, Code 103A, 10 Industrial Highway, Mail Stop #82, Lester, PA 19113-2090] [PACNAVFACENGCOM, Code 102, Pearl Harbor, HI 96860-7300] [SOUTHNAVFACENGCOM, Code 0535, P.O. Box 190010, North Charleston, SC 29419-9010] [SOUTHWESTNAVFACENGCOM, Code 133SB, 1220 Pacific Highway, San Diego, CA 92132-5190].

### 3.9 FORM ONE

FORM 1 - PREFORMED STEEL STANDING SEAM ROOFING SYSTEM COMPONENTS

- 1. Contract Number:
- 2. Building Number & Location:
- 3. NAVFAC Specification Number:
- 4. Deck/Substrate Type:
- 5. Slopes of Deck/Roof Structure:
- 6. Insulation Type & Thickness:
- 7. Insulation Manufacturer:
- 8. Vapor Retarder:     ( )Yes     ( )No
- 9. Vapor Retarder Type:
- 10. Preformed Steel Standing Seam Roofing Description:
  - a. Manufacturer (Name, Address, & Phone No.):
  - b. Product Name:                                   c. Width:                                   d. Gage:
  - e. Base Metal:                                   f. Method of Attachment:
- 11. Repair of Color Coating:
  - a. Coating Manufacturer (Name, Address & Phone No.):
  - b. Product Name:
  - c. Surface Preparation:
  - d. Recoating Formula:
  - e. Application Method:
- 12. Statement of Compliance or Exception: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- 13. Date Roof Completed:
- 14. Warranty Period: From \_\_\_\_\_ To \_\_\_\_\_
- 15. Roofing Contractor (Name & Address):
- 16. Prime Contractor (Name & Address):

Contractor's Signature \_\_\_\_\_ Date:

Inspector's Signature \_\_\_\_\_ Date:

-- End of Section --

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## SECTION 07 72 20

## GRAVITY-TYPE ROOF VENTILATORS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

**ASCE 7-16** (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## ASTM INTERNATIONAL (ASTM)

**ASTM A653/A653M** (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

**ASTM B209** (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

**ASTM B221** (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

## SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

**SMACNA 1793** (2012) Architectural Sheet Metal Manual, 7th Edition

## 1.2 DESIGN REQUIREMENTS

Design ventilators for use with the specific type of project roofing system, and to provide uniform and continuous air flow. Design ventilator to protect against rain and snow, and with a continuous weep along the bottom of both sides of wind band. Units must be self-cleaning by the action of the elements, and must have provisions for carrying water and normal wind-transported soil matter to the outside. Design units for windspeeds of not less than [80] [\_\_\_\_\_] mph in accordance with **ASCE 7-16**. Provide ventilators that are free of internal obstructions or moving parts which will require maintenance and are complete with type of mounting indicated on drawings.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will

review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Roof Ventilators; G[, [\_\_\_\_\_]]

#### 1.4 QUALITY ASSURANCE

Manufacturer must specialize in design and manufacture of the type of roof ventilators specified in this section, and must have a minimum of [\_\_\_\_\_] years of documented successful experience. Provide a ventilator installer experienced in the installation of ventilator types specified.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Carton or crate roof ventilators prior to shipment. Protect ventilators from moisture and damage. Remove damaged items from the site.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Aluminum Extrusions

Aluminum extrusions must be alloy 6063, temper T5 in compliance with [ASTM B221](#).

##### 2.1.2 Aluminum Sheets

Aluminum sheets must be alloy 5005, temper H15 or alloy 3003, temper H14 in compliance with [ASTM B209](#).

##### 2.1.3 Galvanized Steel Sheets

Steel sheets must be commercial quality, zinc-coated steel (hot-dip galvanized) of quality established by [ASTM A653/A653M](#), minimum G90 coating thickness.

#### 2.2 RIDGE VENTILATORS

Provide roof ridge ventilators fabricated of [galvanized steel] [aluminum], and assembled to any desired length. Connect continuous-run ridge ventilators with splice plates of type which will telescope together and not require fasteners, soldering or welding. Provide ventilators with [manually-operated single-leaf dampers complete with accessories to meet design and performance requirements.] [UL labeled fire-actuated damper system complete with accessories to meet building code requirements.] Furnish dampers and airshafts complete with urethane gasketing for extra-tight enclosures. Provide metal closure strips, which match the panel roof rib contours, to close out weather and provide a secure seat for ventilators. Provide [insect] [bird] screens.

#### 2.3 STATIONARY VENTILATORS

Provide stationary roof ventilators fabricated of [galvanized steel] [aluminum] with seamless spun conical-shaped weathercap, and having straight-through drainage for eliminating the possibility of air-borne debris collecting in the ventilator openings. Provide [insect] [bird]

screens.

## 2.4 TURBINE VENTILATORS

Provide turbine ventilators fabricated of [galvanized steel] [aluminum] [corrugated] [flat] sheets, complete with sensitive ball-bearing action to enable the slightest motion of air to move the rotor head where suction is maintained at low wind velocities. Ventilators must have 360 degree operating surface to assure access of wind currents regardless of wind velocities. Anchor rotor head to prevent head from lifting or jumping off the rotor in high winds. Provide seamless motor crown plate. Provide [bird] [Insect] screens.

### 2.4.1 Dampers

Provide turbine ventilators with [dampers manually-operated with direct pull-chain or rack and pinion] [push-button control electric gear motor-operated dampers] [thermostat control electric gear motor-operated dampers].

### 2.4.2 Rotor Shaft

Shield rotor shaft bearings entirely in corrosion-resistant aluminum casing. Provide pre-lubricated, life-time warranted bearings. Place bearings at top and bottom to assure accurate alignment. Shaft and bearings must be easily replaceable as a unit. Roll and weld rotor collar.

## 2.5 FABRICATION

Fabricate ventilators in accordance with approved shop drawings. Welds, soldered seams, rivets and fasteners must be clean, secure, watertight, and smooth. Wire or bead edges, where necessary, to ensure rigidity. Joints between sections must be watertight and must allow for expansion and contraction. Prevent galvanic action between different metals in direct contact by nonconductive separators.

## 2.6 CURB BASES

Ventilator bases for curb-mounted installations must be of size indicated on drawings, and designed specifically for the type of ventilator and roofing system approved for this project. Curb bases must be factory-formed and flashed for a watertight installation. Fabricate curb bases of material and finish to match the ventilator.

## 2.7 SCREENS

Screens must be furnished by ventilator manufacturer as part of ventilator assembly. Screen (with frames) must be manufactured of material to match ventilators, and designed to be easily removed for cleaning purposes.

## 2.8 FINISH

### 2.8.1 Galvanized Steel Finish

Galvanized steel roof ventilators must be factory-coated with rust-resistant primer and [baked-on finish coats of acrylic] [finish coats to match metal roof panels] [two-coat high-performance coating system] [field-painted in accordance with Section 09 90 00 PAINTS AND COATINGS] [\_\_\_\_\_].

### 2.8.2 Aluminum Finish

Provide factory-finished aluminum roof ventilators [to match metal roof finish and color] [with two-coat fluoropolymer high-performance coating system] [\_\_\_\_\_].

### 2.8.3 Color

Color must be in accordance with [Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_].

## PART 3 EXECUTION

### 3.1 PREPARATION

Prepare rough openings and other roof conditions in accordance with approved shop drawings and manufacturer's recommendations. Field-measure rough openings and record on shop drawings prior to fabrication of [roof ventilators](#). Before starting the ventilator work, protect surrounding roof surfaces from damage. Coordinate fabrication with construction schedule. Submit dimensioned drawings indicating location of each type of ventilator including details of construction, gauges of metal, and methods of operation of dampers and controls.

### 3.2 INSTALLATION

Coordinate roof ventilator installation with roofing work, and in accordance with approved shop drawings, manufacturer's published instructions, and chapter 8 of [SMACNA 1793](#). The ventilator installation must be watertight and free of vibration noise. Protect aluminum surfaces from direct contact with incompatible materials. Do not coat aluminum surfaces which will be in contact with sealant with a protective material. Do not use aluminum with copper or with water which flows over copper surfaces. Clean roof ventilators in accordance with ventilator manufacturer's recommendations.

### 3.3 PROTECTION

Protect exposed ventilator finish surfaces against the accumulation of paint, grime, mastic, disfigurement, discoloration and damage for duration of construction activities.

-- End of Section --

## SECTION 07 81 00

## SPRAY-APPLIED FIREPROOFING

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASSOCIATION OF THE WALL AND CEILING INDUSTRY (AWCI)

**AWCI TM 12-A** (1997; 3rd Ed) Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials; An Annotated Guide

## ASTM INTERNATIONAL (ASTM)

**ASTM E84** (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

**ASTM E119** (2020) Standard Test Methods for Fire Tests of Building Construction and Materials

**ASTM E605/E605M** (1993; R 2015; E 2015) Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

**ASTM E736** (2000; R 2011) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

**ASTM E759/E759M** (1992; R 2020) Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members

**ASTM E760/E760M** (1992; R 2020) Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members

**ASTM E761/E761M** (1992; R 2020) Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members

**ASTM E859/E859M** (1993; R 2020) Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members

ASTM E937/E937M	(1993; R 2020) Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
ASTM E1042	(2002; R 2021) Standard Classification for Acoustically Absorptive Materials Applied by Trowel or Spray
ASTM G21	(2015; R 2021; E 2021) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC23	(2012; R 2016) Acceptance Criteria for Sprayed Fire-resistant Materials (SFRMs), Intumescent Fire-resistant Coatings and Mastic Fire-resistant Coatings Used to Protect Structural Steel Members
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UNDERWRITERS LABORATORIES (UL)

UL 263	(2011; Reprint Aug 2021) UL Standard for Safety Fire Tests of Building Construction and Materials
UL Fire Resistance	(2014) Fire Resistance Directory

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 General Requirements

Protect all structural steel, undersides of steel floors (if required) and steel roof decks (if required) with spray-applied fireproofing to a fire resistance hour-rating as indicated below, unless otherwise indicated.

### 1.2.2 Fire Resistance Rating

Fire resistance ratings must be in accordance with the fire rated assemblies listed in [UL Fire Resistance](#). Proposed materials not listed in [UL Fire Resistance](#) must have fire resistance ratings at least equal to the [UL Fire Resistance](#) ratings as determined by an approved independent testing laboratory, based on tests specified in [UL 263](#) or [ASTM E119](#). Submit reports and test records, attesting that the fireproofing material conforms to the specified requirements. Each test report must conform to the report requirements specified by the test method. For the underside of the decking use metal lath installed prior to the fireproofing material or Rigid Board Fireproofing Material as outlined in the [UL Fire Resistance](#) Directory Volume 1. Apply fireproofing to structural steel members, with the following hourly fire resistance rating and in accordance with the following UL design or approved equivalent. Use unrestrained fire resistance ratings, unless the architect/engineer has specified that the degree of thermal restraint of the construction meets or exceeds the degree of thermal restraint of the tested assembly. Performance tests must be in accordance with [ASTM E119](#).

Fire Rating Schedule		
Element	Hourly Rating	UL Design Reference
Columns supporting one floor	[_____]	[_____]
Columns supporting more than one floor	[_____]	[_____]
Columns supporting roof	[_____]	[_____]
Floor decks	[_____]	[_____]
Floor supports	[_____]	[_____]
Roof decks	[_____]	[_____]
Roof supports	[_____]	[_____]

### 1.2.3 Evaluation Reports - ICC-ES Reports

Evaluate materials in accordance with **ICC-ES AC23**. Include ICC-ES Reports as part of the Submittals below. The reports will identify the product as code compliant and having met the physical performance requirements outlined in paragraphs "Dry Density and Cohesion/Adhesion" through "Air Erosion".

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section **01 33 00** SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Fireproofing Material [; G] [; G, [NVFAC]]

#### SD-04 Samples

Spray-Applied Fireproofing [; G] [; G, [NVFAC]]

#### SD-06 Test Reports

Fire Resistance Rating [; G] [; G, [NVFAC]]

Field Tests; G[, [\_\_\_\_\_]]

Evaluation Reports; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Installer Qualifications; G[, [\_\_\_\_\_]]

Surface Preparation Report [; G] [; G, [NVFAC]]

Manufacturer's Inspection Report [; G] [; G, [NVFAC]]

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualifications

Engage an experienced installer that is certified, licensed, or otherwise qualified by the spray-on fireproofing manufacturer as having the necessary experience, staff, and training to install the manufacturer's products in accordance with specified requirements. Submit manufacturer's certification that each listed installer is qualified and trained to install the specified fireproofing. Show evidence that each fireproofing installer has had a minimum of 3 years experience in installing the specified type of fireproofing. Each installer of fireproofing material must be trained, have a minimum of 3 years experience and a minimum of three installations using fireproofing of the type specified. A manufacturer's willingness to sell its products to the Contractor or installer does not infer qualification of the buyer.

1.4.2 Pre-Installation Meeting

Hold a meeting with the installer, field testing agency, the manufacturer, subcontractors (whose employees come into contact with the fireproofing), and the Contracting Officer prior to the installation of any fireproofing material to review the substrates for acceptability, method of application, applied thickness, patching, repair, inspection and testing procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver packaged material in the original unopened containers, marked to show the brand name, the manufacturer, and the UL markings. Keep fireproofing material dry until ready to be used, and store off the ground, under cover and away from damp surfaces. Damaged or opened containers will be rejected. Apply material with shelf-life prior to expiration of the shelf-life.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Temperature

Maintain substrate and ambient air temperatures above 40 degrees F during application and for 24 hours before and after application. Maintain relative humidity within the limits recommended by the fireproofing manufacturer.

1.6.2 Ventilation

Provide adequate ventilation to properly dry the fireproofing after application. In enclosed areas, provide a minimum of 4 air exchanges per hour by forced air circulation.

PART 2 PRODUCTS

2.1 SPRAY-APPLIED FIREPROOFING

Provide spray-applied fireproofing material, including sealer, conforming to ASTM E1042, Class (a), Category A, either Type I or Type II, except that the dust removed must not exceed 0.0025 gram per square foot of



fireproofing material applied as specified in the project. Only products that have been evaluated at UL and bear and "investigated for exterior use" approval are allowed in waterfront areas where the fireproofing may be directly exposed to a natural body of water. Material must be asbestos free, and must resist fungus for a period of 28 days when tested in accordance with ASTM G21. Material must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Submit one sample panel, 18 inches square, for each specified type of fireproofing. Also, prepare a designated sample area of not less than 100 square feet. Sample area must be representative of typical installation of fireproofing including metal decks, beams, columns and attachments. Equipment, materials and procedures used in the sample area must be the same as, or representative of, that to be used in the work. The sample area must be approved prior to proceeding with fireproofing work in any other area. Use the approved sample area as a reference standard for applied fireproofing material. Keep sample area in place and open to observation until all spray-applied fireproofing is completed and accepted, at which time it may become part of the work.

#### 2.1.1.1 Dry Density and Cohesion/Adhesion

Fireproofing must have a minimum ASTM E605/E605M dry density and ASTM E736 cohesion/adhesion properties as follows:

##### 2.1.1.1.1 Concealed Structural Components

Fireproofing for structural components concealed above the ceiling, or within a wall, chase, or furred space, must have a [minimum] [average] applied dry density of 15 pounds per cubic foot and a cohesion/adhesion strength of 200 psf.

##### 2.1.1.1.2 Exposed Structural Components

Fireproofing for exposed structural components, except where otherwise specified or indicated, must have a minimum applied dry density of 22 pounds per cubic foot and a cohesion/adhesion strength of 434 psf.

##### 2.1.1.1.3 Mechanical Rooms and Storage Areas

Fireproofing for structural components located in mechanical rooms and storage areas must have a minimum applied dry density of 40 pcf and a cohesion/adhesion strength of [1,000] [\_\_\_\_\_] psf.

#### 2.1.2 Deflection

Spray-applied fireproofing must not crack, spall, or delaminate when backing to which it is applied is subject to downward deflection 1/120 of 10 foot clear span, when tested in accordance with ASTM E759/E759M.

#### 2.1.3 Bond-Impact

Spray-applied fireproofing material must not crack, spall or delaminate when tested in accordance with ASTM E760/E760M.

#### 2.1.4 Compressive Strength

Provide minimum compressive strength of 1000 psf when tested in accordance with ASTM E761/E761M.

### 2.1.5 Corrosion

Spray-applied fireproofing material must not contribute to corrosion of test panels when tested as specified in [ASTM E937/E937M](#).

### 2.1.6 Air Erosion

Dust removal exceeding 0.025 gram per square foot when tested in accordance with [ASTM E859/E859M](#) is not acceptable.

## 2.2 SEALER

Provide sealer approved by the manufacturer of the fireproofing material, that is fungus resistant, has a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with [ASTM E84](#), and has a [white] [\_\_\_\_\_] [or] [green] color.

## 2.3 WATER

Use potable water for material mixing and surface preparation .

## 2.4 SPRAY-APPLIED INTUMESCENT EPOXY COATING SYSTEM

Provide a two-component epoxy based intumescent fire protective coating that meets the following requirements.

- a. On curing it forms a flexible and tough epoxy barrier which transforms into a ceramic-like, insulating char to provide thermal protection of the substrate in the event of a fire.
- b. The coating system includes the manufacturer's required surface preparation, primer, and fire protective layer, and topcoat.
- c. The coating system protects the substrate from corrosion and retain its fire protection properties under aggressive chemical environments.
- d. Resistant to solvents, acids, alkalis, salts and abrasion while retaining its fire protective properties.

Provide a system that exhibits the following properties:

### 2.4.1 Percent Solids by Weight

100 percent

### 2.4.2 In Service Temperature Restrictions

Up to 150 degrees F

### 2.4.3 Application Method

Air spray or specialized plural component airless equipment approved by the manufacture. Troweling can be used for small areas or touch-up work.

### 2.4.4 Drying Time

Approximately 24 hours to achieve a Shore D hardness of 25.

### 2.4.5 Shelf Life

Minimum shelf life under proper storage condition is 1 Year from date of manufacture.

#### 2.4.6 Pot Life

Approximately 40 minutes at 77 degrees F and 50 percent relative humidity. Pot life is not a factor when using specialized plural component airless spray equipment.

#### 2.4.7 Flash Point

Greater than 212 degrees F Pensky-Martens for each component.

### PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

Thoroughly clean surfaces to be fireproofed of dirt, grease, oil, paint, primers, loose rust, rolling lubricant, mill scale or other contaminants that will interfere with the proper bonding of the sprayed fireproofing to the substrate. Test painted/primed steel substrates in accordance with [ASTM E736](#), with specified sprayed fireproofing material, to provide the required fire-resistance rating; painted or primed steel surfaces may require a fireproofing bond test to determine if the paint formulation will impair proper adhesion. Certify the acceptability of surfaces to receive sprayed-applied fireproofing by inspection and submit a [Surface Preparation Report](#) accordingly. List the structural members and the areas that have been inspected and certified. Clear overhead areas to be fireproofed of all obstructions interfering with the uniform application of the spray-applied fireproofing. Install hardware such as support sleeves, inserts, clips, hanger attachment devices and the like prior to the application of the fireproofing. Condition of the surfaces must be acceptable to the manufacturer prior to application of spray-applied fireproofing. Applications listed for use on primed surfaces must be in accordance with the manufacturer's recommendations and standards, and detailed in submittal item SD-03 Product Data.

#### 3.2 PROTECTION

Cover surfaces not to receive spray-applied fireproofing to prevent contamination by splatter, rebound and overspray. Cover exterior openings in areas to receive spray-applied fireproofing prior to and during application of fireproofing with tarpaulins or other approved material. Clean surfaces not to receive fireproofing of fireproofing and sealer.

#### 3.3 FIREPROOFING MATERIAL

Mix fireproofing material in accordance with the manufacturer's recommendations. Submit data identifying performance characteristics of fireproofing material. Data includes recommended application requirements and indicate thickness of fireproofing to be applied to achieve each required fire rating.

#### 3.4 APPLICATION

##### 3.4.1 Sequence

Prior to application of fireproofing on each floor, inspect and approve

application equipment, water supply and pressure, and the application procedures. If fireproofing is required to be applied to underside of steel roof deck and steel floor assemblies, apply it only after respective roof or floor construction is complete. Do not allow roof or floor traffic during application. Apply fireproofing material prior to the installation of ductwork, piping and conduits which would interfere with uniform application of the fireproofing.

#### 3.4.2 Application Technique

Maintain water pressure and volume to manufacturer's recommendations throughout the fireproofing application. Apply fireproofing material to the thickness and density established for the specified fire resistance rating, in accordance with the procedure recommended by the manufacturer, and to a uniform density and texture. Do not tamp fireproofing material to achieve the desired density.

#### 3.4.3 Sealer Application

If sealer is required by the product used, apply it after field testing has been conducted and after corrective measures and repairs, if required, have been completed.

#### 3.4.4 Applied Thickness

The minimum average thickness must be no less than 0.375 inches. Thicknesses must not be less than required to achieve designated fire resistance ratings. If the specified thickness is greater than or equal to 1 inch, any individual measurement must not be less than the specified thickness minus 0.25 inches. If the specified thickness is less than 1 inch, any individual measurement must not be less than the specified thickness minus 25 percent.

#### 3.4.5 Application of Spray-Applied Intumescent Epoxy Coating System

Prepare surfaces and apply the spray-applied Intumescent epoxy coating system in accordance with the manufacturer's written recommendations.

### 3.5 MANUFACTURER'S SERVICES

#### 3.5.1 General

The manufacturer, or its representative, must be onsite prior to, periodically during, and at completion of the application, to provide the specified inspections and certifications; and to ensure that preparations are adequate and that the material is applied according to manufacturer's recommendations and the contract requirements.

#### 3.5.2 Manufacturer's Inspection

Inspect the fireproofing work after the work is completed on each floor or area, including testing, repair and clean-up, and certify that the work complies with the manufacturer's criteria and recommendations. Before the sprayed material is covered, and after all of the fireproofing work is completed, including repair, testing, and clean-up; and after mechanical, electrical and other work in contact with fireproofing material has been completed, re-inspect the work and certify that the entire project complies with the manufacturer's criteria and recommendations. Obtain and submit the [Manufacturer's Inspection Report](#) and certifications of approval stating

that the spray-applied fireproofing in the entire project complies with the manufacturer's criteria and recommendations.

### 3.6 FIELD TESTS

Test the applied fireproofing by an approved independent testing laboratory to be selected by the A/E and paid for by the Contractor. Submit test reports documenting results of tests on the applied material in the project. Include defects identified, repair procedures, and results of the retests when required. Perform the tests in approved locations: for density in accordance with ASTM E736, cohesion/adhesion in accordance with ASTM E736, and for thickness in accordance with ASTM E605/E605M. Determine densities in accordance with ASTM E605/E605M or Appendix A, "Alternate Method for Density Determination" of AWCI TM 12-A. Take density determinations at the flat portion of deck, beam bottom flange, beam web, column, and an equivalent area from the top of the lower beam flange. Areas showing a density less than specified will be rejected. Locate a test sample every 10,000 square feet of floor area or two for each floor, whichever produces the greatest number of test areas. Correct any area showing less than minimum requirements. Proposed corrective measures, in writing, must be approved before starting the corrective action. Retest corrected work.

#### 3.6.1 Structural Components

Test each structural component type at floor and roof decks, beams, columns, joists, and trusses. Minimum average thickness must be as [indicated] [or] [required by UL Fire Resistance]. Density and cohesion/adhesion must be as specified.

#### 3.6.2 Repair

Additional fireproofing material may be added to provide proper thickness. Correct rejected areas of fireproofing to meet specified requirements by adding fireproofing material to provide the proper thickness, or by removing defects and respraying with new fireproofing material. Use same type of fireproofing material for repairs as originally applied or use patching materials recommended by the manufacturer. Retest and reinspect repaired areas. Apply fireproofing material to voids or damaged areas by hand-trowel, or by respraying.

#### 3.6.3 Visual Inspections

Inspections must be made by the certified independent laboratory prior to closure of concealed areas. These inspections may be phased, but must not occur less than 5 working days prior to the enclosure of the fireproofing. Sprayed areas must receive a final inspection. Inspect fireproofed surfaces after mechanical, electrical, and other work in contact with fireproofing material has been completed and before sprayed material is covered. Patch any locations missing fireproofing in accordance with the manufacturer's requirements.

#### 3.6.4 Patching

Patch and repair damaged fireproofing. The patching material must be the same as that specified for that area.

### 3.7 CLEANUP

Thoroughly clean surfaces not indicated to receive fireproofing of sprayed material within a 24 hour period after application.

-- End of Section --

## SECTION 07 84 00

## FIRESTOPPING

05/10, CHG 1: 08/13

## PART 1 GENERAL

## 1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; do not allow firestopping material to interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E699	(2009) Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
ASTM E814	(2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E1399/E1399M	(1997; R 2017) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2015; R 2019) Standard Test Method for Fire-Resistive Joint Systems

ASTM E2174	(2020a) Standard Practice for On-Site Inspection of Installed Firestop Systems
ASTM E2307	(2020) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2020a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

## FM GLOBAL (FM)

FM 4991	(2013) Approval of Firestop Contractors
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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## UNDERWRITERS LABORATORIES (UL)

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 1479	(2015; Reprint May 2021) Fire Tests of Through-Penetration Firestops
UL 2079	(2015; Reprint Jul 2020) Tests for Fire Resistance of Building Joint Systems
UL Fire Resistance	(2014) Fire Resistance Directory

## 1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials, at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Locate cast-in-place firestop devices and install in place before concrete placement. Install pipe, conduit or cable bundles through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material must be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in



accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System; G[, [\_\_\_\_]]

SD-03 Product Data

Firestopping Materials; G[, [\_\_\_\_]]

SD-06 Test Reports

Inspection; G[, [\_\_\_\_]]

SD-07 Certificates

Inspector Qualifications

Firestopping Materials

Installer Qualifications; G[, [\_\_\_\_]]

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage an experienced Installer who is:

- a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or
- b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer must be a trained representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. Obtain and submit installer's written certification of training, and retain proof of certification for duration of firestop installation.

1.5.2 Inspector Qualifications

The inspector must [meet the criteria contained in ASTM E699 for agencies involved in quality assurance and must] have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector must be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector must not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

## PART 2 PRODUCTS

### 2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to **UL Fire Resistance** or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, submit a manufacturer's engineering judgment, derived from similar UL system designs or other tests for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

### 2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products **FM APP GUIDE** approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

#### 2.2.1 Fire Hazard Classification

Provide material that has a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with **ASTM E84** or **UL 723**. Provide an approved firestopping material as listed in **UL Fire Resistance** or by a nationally recognized testing laboratory.

#### 2.2.2 Toxicity

Provide material that is nontoxic and carcinogen free to humans at all stages of application or during fire conditions and does not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

#### 2.2.3 Fire Resistance Rating

Firestop systems must be **UL Fire Resistance** listed or **FM APP GUIDE** approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems must also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

##### 2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, must provide "F", "T" and "L" fire resistance ratings in accordance with [ASTM E814](#) or [UL 1479](#). Provide fire resistance ratings as follows:

#### 2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = [[\_\_\_\_\_] hour] [Rating of wall or partition being penetrated].

#### 2.2.3.1.2 Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the Ceiling Membrane of Roof-Ceiling Assemblies

F Rating = [\_\_\_\_\_] hour, T Rating = [\_\_\_\_\_] hour. Where the penetrating item is outside of a wall cavity the F rating must be equal to the fire resistance rating of the floor penetrated, and the T rating must be in accordance with the requirements of [ICC IBC](#).

#### 2.2.3.1.3 Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies

F Rating = [\_\_\_\_\_] hour, T Rating = [\_\_\_\_\_] hour and L Rating = [[<10] cfm/sf] [Where L rating is required].

#### 2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls must be [the same as the construction in which they occur.] [as follows: construction joints in walls, [\_\_\_\_\_] hour; construction joints in floors, [\_\_\_\_\_] hour; gaps between floor slabs and curtain walls, [\_\_\_\_\_] hour; gaps between top of the walls and the bottom of roof and floor decks, [\_\_\_\_\_] hour, and provide L rating of <5 cfm/lf where required.] Provide construction joints and gaps with firestopping materials and systems that have been tested in accordance with [ASTM E119](#), [ASTM E1966](#) or [UL 2079](#) to meet the required fire resistance rating. Provide curtain wall joints with firestopping materials and systems that have been tested in accordance with [ASTM E2307](#) to meet the required fire resistance rating. Systems installed at construction joints must meet the cycling requirements of [ASTM E1399/E1399M](#) or [UL 2079](#). Provide a minimum class II movement capability for all joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly.

#### 2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. Provide certification of compliance with [UL 1479](#) for all intumescent firestop materials used in through penetration systems.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

### 3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

#### 3.2.1 Insulated Pipes and Ducts

Cut and remove thermal insulation where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

#### 3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 30 00 HVAC AIR DISTRIBUTION. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

#### 3.2.3 Data and Communication Cabling

Seal cabling for data and communication applications with re-enterable firestopping [products] [devices] [products and devices as indicated].

##### 3.2.3.1 Re-Enterable Devices

Provide firestopping devices that are pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf [measured at ambient temperature and 400 degrees F] at 0 percent to 100

percent visual fill.

### 3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Allow for cable moves, additions or changes. Provide devices capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

## 3.3 INSPECTION

[For Navy projects, install one of each type of penetration and have it inspected and accepted by the [\_\_\_\_\_] Division, Naval Facilities Engineering Command, Fire Protection Engineer prior to the installation of the remainder of the penetrations. At this inspection, the manufacturer's technical representative of the firestopping material must be present.] For all projects, do not cover or enclose [ the remainder of] [ the firestopped areas] until inspection is complete and approved by the Contracting Officer. [The inspector must inspect] [Inspect] the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL listed printed numbers.

### 3.3.1 Inspection Standards

Inspect all firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

### 3.3.2 Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

-- End of Section --

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## SECTION 07 92 00

JOINT SEALANTS  
08/16, CHG 3: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2021) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2015; R 2019) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C834	(2017) Standard Specification for Latex Sealants
ASTM C919	(2022) Standard Practice for Use of Sealants in Acoustical Applications
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM C1311	(2014) Standard Specification for Solvent Release Agents
ASTM C1521	(2013) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
ASTM D217	(2019b) Standard Test Methods for Cone Penetration of Lubricating Grease
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2452	(2015; R 2019) Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds
ASTM D2453	(2015; R 2020; E 2020) Standard Test

Method for Shrinkage and Tenacity of Oil-  
and Resin-Base Caulking Compounds

ASTM E84

(2020) Standard Test Method for Surface  
Burning Characteristics of Building  
Materials

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350

(2010; Version 1.1) Standard Method for  
the Testing and Evaluation of Volatile  
Organic Chemical Emissions from Indoor  
Sources using Environmental Chambers

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS

SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168

(2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-03 Product Data

Sealants; G[, [\_\_\_\_\_]]

Primers; G[, [\_\_\_\_\_]]

Bond Breakers; G[, [\_\_\_\_\_]]

Backstops; G[, [\_\_\_\_\_]]

### SD-06 Test Reports

Field Adhesion; G[, [\_\_\_\_\_]]

### SD-07 Certificates

Indoor Air Quality For Interior Sealants; S

Indoor Air Quality For Interior Floor Joint Sealants; S

Indoor Air Quality For Interior Acoustical Sealants; S



## Indoor Air Quality For Interior Caulking; S

## 1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Safety Data Sheets (SDS) for each solvent, primer and sealant material proposed.

## [1.4 CERTIFICATIONS

## 1.4.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

## 1.4.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

## ]1.5 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between [40 and 90 degrees F](#).

## 1.6 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, [color,] and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding [90 degrees F](#) or lower than [0 degrees F](#). Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

## 1.7 QUALITY ASSURANCE

## 1.7.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

## 1.7.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

## 1.7.3 Mock-Up

Provide a mock-up of each type of sealant using materials, colors, and techniques approved for use on the project. Approved mock-ups may be incorporated into the Work.

1.7.4 Adhesion

Provide in accordance with [ASTM C1193](#) or [ASTM C1521](#).

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

[ In areas with ambient temperatures that exceed [110 degrees F](#), do not use polybutene, bituminous, acrylic-latex, polyvinyl acetate latex sealants, polychloroprene (neoprene), polyvinyl chloride (PVC), and polyurethane foams, and neoprene, PVC, and styrene butadiene rubber extruded seals and closure strips due to these materials having maximum recommended surface temperature ranges from [130 to 180 degrees F](#).

]2.1.1 Interior Sealants

Provide[ [ASTM C834](#)][ [ASTM C920](#), Type S or M, Grade NS, Class 12.5, Use NT]. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide certification or validation of [indoor air quality for interior sealants](#). Location(s) and color(s) of sealant for the following. Note, color "as selected" refers to manufacturer's full range of color options

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface mounted equipment and fixtures, and similar items.	[As selected] [Gray] [White] [_____]
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	[_____]
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	[_____]
d. Joints between edge members for acoustical tile and adjoining vertical surfaces.	[_____]
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	[_____]
f. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where non-planar tile surfaces meet.	[_____]

LOCATION	COLOR
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	[_____]
h. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	[_____]
i. [_____]	[_____]

2.1.2 Exterior Sealants

For joints in vertical surfaces, provide **ASTM C920**, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide **ASTM C920**, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	[Match adjacent surface color] [As selected] [Gray] [White] [_____]
b. Joints between new and existing exterior masonry walls.	[_____]
c. Masonry joints where shelf angles occur.	[_____]
d. Joints in wash surfaces of stonework.	[_____]
e. Expansion and control joints.	[_____]
f. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	[_____]
g. Voids where items pass through exterior walls.	[_____]
h. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	[_____]
i. Metal-to-metal joints where sealant is indicated or specified.	[_____]

LOCATION	COLOR
j. Joints between ends of gravel stops, fascia, copings, and adjacent walls.	[_____]
k. [_____]	[_____]

2.1.1.3 Floor Joint Sealants

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide certification or validation of indoor air quality for interior floor joint sealants. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	[As selected] [Gray] [White] [_____]
b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.	[_____]

2.1.1.4 Acoustical Sealants

[\_\_\_\_\_] Rubber or polymer based acoustical sealant in accordance with ASTM C919 to have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Provide non-staining acoustical sealant with a consistency of 250 to 310 when tested in accordance with ASTM D217. Acoustical sealant must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide certification or validation of indoor air quality for interior acoustical sealants.

2.1.1.5 Preformed Sealants

Provide preformed sealants of polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealants capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, sealants must be non-bleeding and have no loss of adhesion.

2.1.1.5.1 Tape

[\_\_\_\_\_] Tape sealant: Provide cross section dimensions of [\_\_\_\_\_].

2.1.1.5.2 Bead

[\_\_\_\_\_] Bead sealant: Provide cross section dimensions of [\_\_\_\_\_] .

#### 2.1.5.3 Foam Strip

Provide [\_\_\_\_\_] foam strip of polyurethane foam with cross section dimensions of [\_\_\_\_\_] . Provide foam strip capable of sealing out moisture, air, and dust when installed and compressed in accordance with manufacturer's printed instructions. Service temperature must be **minus 40 to plus 275 degrees F**. Furnish untreated strips with adhesive to hold them in place. Do not allow adhesive to stain or bleed onto adjacent finishes. Saturate treated strips with butylene waterproofing or impregnate with asphalt.

### 2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

### 2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

### 2.4 BACKSTOPS

Provide glass fiber roving, neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Provide backstop material that is compatible with sealant. Do not use oakum[, [\_\_\_\_\_] ] or other types of absorptive materials as backstops.

#### 2.4.1 Rubber

Provide in accordance with **ASTM D1056**, [Type 1, open cell,] [or] [Type 2, closed cell,] Class [A] [B] [D], Grade [\_\_\_\_\_] , [round] [\_\_\_\_\_] cross section for [\_\_\_\_\_] cellular rubber sponge backing.

#### 2.4.2 PVC

Provide in accordance with **ASTM D1667**, Grade [VO 12] [\_\_\_\_\_] , open-cell foam, [round] [\_\_\_\_\_] cross section for [\_\_\_\_\_] polyvinyl chloride (PVC) backing.

#### 2.4.3 Synthetic Rubber

Provide in accordance with **ASTM C509**, Option [I] [II], Type [I] [II] preformed [rods] [or] [tubes] for [\_\_\_\_\_] synthetic rubber backing.

#### 2.4.4 Neoprene

Provide in accordance with **ASTM D1056**, [closed cell expanded neoprene cord Type 2, Class C, Grade [2C2] [\_\_\_\_\_] ] [open cell neoprene sponge Type 1,

Class C, Grade [1C3] [\_\_\_\_\_] for [\_\_\_\_\_] neoprene backing.

#### 2.4.5 Butyl Rubber Based

Provide in accordance with [ASTM C1311](#), from a single component, with solvent release. color [as selected from manufacturer's full range of color choices] [\_\_\_\_\_].

#### 2.4.6 Silicone Rubber Base

Provide in accordance with ASTM C920, from a single component, with solvent release, Non-sag, Type [\_\_\_\_\_] , Grade [\_\_\_\_\_] , Class [25] [\_\_\_\_\_]. Color [as selected from manufacturer's full range of color choices] [\_\_\_\_\_].

### 2.5 CAULKING

For interior use and only where there is little or no anticipated joint movement. Provide in accordance with [ASTM D2452](#) and [ASTM D2453](#), Type [\_\_\_\_\_] , for [\_\_\_\_\_] oil and resin-based caulking. Provide products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide certification or validation of [indoor air quality for interior caulking](#).

### 2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer and in accordance with environmental requirements herein. [Protect adjacent aluminum and bronze surfaces from solvents]. Provide solvents for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

## PART 3 EXECUTION

### 3.1 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions and [ASTM C1193](#), Method A or ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit [field adhesion](#) test report indicating tests, locations, dates, results, and remedial actions taken.

### 3.2 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

#### 3.2.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical

or would damage finished work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue free solvent. Remove resulting debris and solvent residue prior to sealant installation.

3.2.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive prior to sealant application. For removing protective coatings and final cleaning, use non-staining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.2.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

3.2.4 Wood Surfaces

Ensure wood surfaces that will be in contact with sealants are free of splinters, sawdust and other loose particles.

[3.2.5 Removing Existing Hazardous Sealants

For sealants applied prior to 1979, or that have been tested and found to contain polychlorinated biphenyls (PCBs), remove and dispose of these sealants in accordance with Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs).

]3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.4 APPLICATION

3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

<u>JOINT WIDTH</u>	<u>JOINT DEPTH</u>	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry, stone, or [____]:		
1/4 inch (minimum)	1/4 inch	1/4 inch

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
over 1/2 inch to 1 inch	1/2 inch	5/8 inch
Over 1 inch	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

#### 3.4.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

#### 3.4.3 Masking Tape

Place masking tape on the finished surface on one or both sides of joint cavities to protect adjacent finished surfaces from primer or sealant smears. Remove masking tape within 10 minutes of joint filling and tooling.

#### 3.4.4 Backstops

Provide backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide joints in specified depths. Provide backstops where indicated and where backstops are not indicated but joint cavities exceed the acceptable maximum depths specified in JOINT WIDTH-TO-DEPTH RATIOS Table.

#### 3.4.5 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

#### 3.4.6 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

#### 3.4.7 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so



as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

### 3.5 PROTECTION AND CLEANING

#### 3.5.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

#### 3.5.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent moistened cloth. Remove solvent residue in accordance with solvent manufacturer's printed instructions.

-- End of Section --

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## SECTION 08 01 52

## OPERATION AND MAINTENANCE OF WOOD WINDOWS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

[ASTM C1184](#) (2014) Standard Specification for Structural Silicone Sealants

## U.S. GREEN BUILDING COUNCIL (USGBC)

[LEED BD+C](#) (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)

## 1.2 SYSTEM DESCRIPTION

Repair wood windows as indicated, and return them to proper operation and sound condition.

## 1.3 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section [01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING](#) for project [LEED BD+C](#) [ local/regional materials,] [ low-emitting materials,] [ recycled content,] [ [\\_\\_\\_\\_\\_](#)] [ and ] [ rapidly renewable materials] and [LEED documentation](#) requirements.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

[SD-02 Shop Drawings](#)

[Shop Drawings; G\[, \[\[\\\_\\\_\\\_\\\_\\\_\]\(#\)\]\]](#)

[SD-03 Product Data](#)

[Hardware](#)

[Weatherstripping](#)

[Qualifications](#)

## SD-04 Samples

Hardware

Moldings

Weatherstripping

## SD-11 Closeout Submittals

LEED Documentation

## 1.5 QUALITY ASSURANCE

- a. Provide qualified workers trained and experienced in repairing, restoring, replicating, and replacing windows in historic buildings; submit documentation of their [Qualifications](#) during 5 consecutive years of work of this type; and a list of installations made identifying when, where and for whom the installations were made.
- b. Submit [Shop Drawings](#) indicating elevations of units, full-size sections, fastenings, methods of installation and anchorage, method of glazing, locations of operating hardware, mullion details, method and material for weatherstripping, insect screen, details, connections with other work and window schedules showing location of each window unit.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Store materials out of contact with the ground and under weathertight covering.

## PART 2 PRODUCTS

## 2.1 MATERIALS

Reuse existing materials whenever possible in the repair and rehabilitation of historic wood windows. This includes all wood elements, hardware and glazing that are determined to be of historic significance. Replace window elements with new material only when originals are so deteriorated as to prohibit their useful function.

## 2.2 WOOD

Use wood of the same species and grade as the original to replace deteriorated window members, unless otherwise noted. Finger-jointed stock may be used for interior casing and trim only where scheduled to be painted.

## 2.3 GLASS AND GLAZING

Reuse existing intact original glass. Reuse removed lights in their original frames and positions. New glass and glazing materials must conform to Section [08 81 00 GLAZING](#).

2.4 [HARDWARE](#)

Reuse existing original hardware, when it is salvageable. Replacement hardware must match original in design, material, and finish. Submit Manufacturer's installation instructions for each type of hardware and

weatherstripping; see paragraph WEATHERSTRIPPING in PART 3. Submit representative sample of each type of hardware with identifying tags.

## 2.5 FASTENERS

Provide stainless steel, galvanized, or non-ferrous metal fasteners.

## 2.6 GLAZING COMPOUND

Provide glazing compound for single pane glass which is oil-based, non-staining and non-bleeding. Reglaze existing insulated glass units with silicone sealant complying with [ASTM C1184](#) and compatible with the unit seal on the glass unit.

## 2.7 GLAZING POINTS

Provide stainless steel or galvanized steel glazing points.

## 2.8 EPOXY CONSOLIDANTS

### 2.8.1 Liquid Consolidant

Provide liquid wood consolidant consisting of a two-part, low-viscosity liquid epoxy that meets the criteria of Table A.

### 2.8.2 Epoxy Paste

Provide epoxy paste consisting of a two-part, thixotropic paste that meets the criteria of Table A.

TABLE A		
	LIQUID CONSOLIDANT	EPOXY PASTE
Properties	Low-Viscosity Liquid	No-Slump, Thixotropic Paste
Toxicity	Low	Very Low
Toxicity Cured	Non-Toxic	Non-Toxic
Ratios	1:1 by Volume	1:1 by Volume
Pot Life @ Room Temp.	30 minutes minimum	50 minutes minimum
Hardening @ Room Temp.	1 hr. or longer	1 hr. or longer
Hardening @ 140 deg. F	16 min. or less	18 min. or less
Viscosity Poises @72 deg F	4.7 max.	Thixotropic paste
Solids	95% minimum	98% minimum
Tensile Strength	4000 psi	2500 psi

TABLE A		
	LIQUID CONSOLIDANT	EPOXY PASTE
Elongation ( percent)	50	4

### PART 3 EXECUTION

#### 3.1 EVALUATION

Perform a complete evaluation survey of the existing conditions of each wood window to determine the extent of repairs necessary. The evaluation survey may be in the form of a schedule and must note at a minimum:

- a. Window location.
- b. Condition of the paint.
- c. Condition of the frame and sill.
- d. Condition of the interior and exterior trim.
- e. Condition of the sash (including rails, stiles, and muntins).
- f. Glazing problems.
- g. Window hardware and operating system.
- h. The overall condition of the window.

#### 3.2 REPAIRS

##### 3.2.1 Example Window

Prepare an existing window of each type to serve as an example of the quality of repairs to be provided for inspection and approval by the Contracting Officer.

##### 3.2.2 Sash Removal

Remove the interior stops first, in a method so as to not scar the wood. Detach connecting hardware and operating mechanisms and remove the sash from the frame. Identify removed sashes and frames as to location to assure reinstallation in their original positions. For windows with counter-weight systems, detach the sash cords from the sides of the sash and pin their ends with a nail or tie in a knot to prevent them from falling into the weight pocket; the lower sash can then be removed. Remove the parting bead so as to not scar the wood. Install plastic covering or plywood to cover the window opening during repairs.

##### 3.2.3 Paint Removal

Remove paint from areas on frame, sill, sash and muntins where paint or varnish has peeled, alligatored, blistered or crazed, to bare wood or first sound paint layer, using non-destructive means such as a chemical stripper or heat gun. If chemical strippers are used, neutralize wood after stripping to a litmus pH of 5 to 8.5. Allow wood to dry to a moisture content of 8 to 12 percent before repainting. If heat methods are used for

paint removal, protect glass from sudden temperature change to avoid breakage.

#### 3.2.4 Wood Repair

Remove badly decayed areas (with more than 30 percent wood decayed) from wood sash, sill, frame, and trim assemblies. Patch moderately decayed areas (less than 30 percent decayed), weathered, or gouged wood with approved patching compounds, and sand smooth. Repair intact sash rails and stiles that are loose with new dowels to make joints tight.

#### 3.2.5 Epoxy Wood Repair

Apply epoxy wood repair materials in accordance with manufacturer's written instructions. Follow health and safety instructions in accordance with the manufacturer's instructions. Identify the source or cause of wood decay and correct prior to application of patching materials. Dry wet wood to a moisture content of 8 to 12 percent to its full depth before patching. Clean dust, grease, and loose paint from wood that is to be patched. Use clean mixing equipment to avoid contamination. Provide mix and proportions as directed by the manufacturer. Provide batches large enough to complete the specific job intended. Cure patching materials before painting or reinstalling patched pieces.

##### 3.2.5.1 Epoxy Liquid Wood Consolidant

Use epoxy liquid wood consolidant to penetrate and impregnate deteriorated wood sections to reinforce wood fibers that have become softened or absorbent.

##### 3.2.5.2 Epoxy Paste

Use epoxy paste to fill areas where portions of wood are missing such as holes, cracks, gaps, gouges, and other voids. Prime areas to receive epoxy paste patching material with compatible epoxy liquid wood consolidant or a primer recommended by the manufacturer.

#### 3.2.6 Wood Replacement

Replace pieces decayed beyond repair with new pieces that match originals in all respects. Match joinery to existing. Provide muntins consisting of coped mortise and tenon joints. Provide molded members that have mitered or coped joints.

#### 3.2.7 Hardware

Reuse existing hardware, which is in good condition, unless otherwise noted. Strip reused existing hardware of paint down to bare metal. Install new hardware where original is missing, damaged, or unsuitable for new operation, in accordance with manufacturer's directions to provide a secure and smoothly operating window assembly.

#### 3.2.8 Glazing

Reinstall lights to be reused in their original frames and positions. Brush rabbeted integral glazing recesses with boiled linseed oil prior to the application of bed glazing compound. Replace broken glass as specified in Section 08 81 00 GLAZING.

### 3.2.9 Operating System

Repair windows with counter-weight systems to original operating function. Reuse original sash weights (and sash chains, if applicable) wherever possible. Replace missing weights and sash cords or chains. Replace missing or deteriorated sash cords with new cotton-polypropylene cord rated for sash weight. When new weights are required, match the originals in weight. Provide cast iron or square milled steel bar stock replacement weights.

### 3.2.10 Weatherstripping and Moldings

Install [Weatherstripping](#) on all operable windows. Provide weatherstripping consisting of brass, compression or interlocking weather strips designed for permanent sealing under bumper or wiper action. Provide weatherstripping at the perimeter of each sash including meeting rails and install in accordance with manufacturer's instructions. Submit a [12 inch](#) long sample of each type of weatherstripping required with fasteners. Weatherstripping must be completely concealed when sash is closed. Install [moldings](#) in accordance with manufacturer's instructions. Submit a [12 inch](#) long piece of each molding type required for each window and casing with specified finish.

## 3.3 PAINTING PREPARATION

Scrape, sand, and feather edges in areas where paint was removed or where existing paint shows crazing, wrinkling, and intercoat peeling. Remove paint to bare wood or first sound paint layer. Clean all parts by brush using bleach and/or trisodium phosphate (TSP) solution, and let dry. Degloss existing finish. Fill open joints and cracks with epoxy repair materials. Caulk perimeter of fixed sash.

## 3.4 PAINTING

Prime and paint wood elements in accordance with Section [09 90 00](#) PAINTS AND COATINGS.

## 3.5 REASSEMBLY

After repairs are completed, reassemble the window with all parts tight, true and functioning properly. Wood surfaces must be free of blemishes.

## 3.6 ADJUSTMENTS

Make final adjustment, for proper operation of ventilating unit, after reassembly. Make adjustments to operating sash or ventilators to assure smooth operation and weathertight performance when locked closed.

## 3.7 CLEANING

Clean windows on both exterior and interior sides.

-- End of Section --



## SECTION 08 11 13

## STEEL DOORS AND FRAMES

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN WELDING SOCIETY (AWS)

**AWS D1.1/D1.1M** (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

**ASTM A653/A653M** (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

**ASTM A879/A879M** (2012; R 2017) Standard Specification for Steel Sheet, zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

**ASTM A924/A924M** (2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

**ASTM C578** (2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

**ASTM C591** (2021) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

**ASTM C612** (2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation

**ASTM D2863** (2019) Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

**ASTM E1300** (2016) Standard Practice for Determining Load Resistance of Glass in Buildings

**ASTM F2247** (2018) Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Load Method)

ASTM F2248 (2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

ASTM F2927 (2012) Standard Test Method for Door Systems Subject to Airblast Loadings

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2016) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 810 (2009) Hollow Metal Doors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2022) Standard for Fire Doors and Other Opening Protectives

NFPA 105 (2022) Standard for Smoke Door Assemblies and Other Opening Protectives

NFPA 252 (2022) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111 (2009) Recommended Details for Standard Steel Doors, Frames, and Accessories and Related Components

SDI/DOOR 113 (2013; R2018) Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies

SDI/DOOR A250.3 (2019) Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames

SDI/DOOR A250.4 (2018) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors

SDI/DOOR A250.6 (2015) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames

SDI/DOOR A250.8 (2017) Specifications for Standard Steel Doors and Frames

SDI/DOOR A250.11 (2012) Recommended Erection Instructions for Steel Frames

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01

(2018; with Change 1, 2020) DoD Minimum  
Antiterrorism Standards for Buildings

UNDERWRITERS LABORATORIES (UL)

UL 10C

(2016; Reprint May 2021) UL Standard for  
Safety Positive Pressure Fire Tests of  
Door Assemblies

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Doors; G[, [\_\_\_\_\_]]

Frames; G[, [\_\_\_\_\_]]

Accessories

Schedule of Doors; G[, [\_\_\_\_\_]]

Schedule of Frames; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Doors; G[, [\_\_\_\_\_]]

Recycled Content for Steel Door Product; S

Frames; G[, [\_\_\_\_\_]]

Recycled Content for Steel Frame Product; S

Accessories

## [ SD-04 Samples

Factory-applied Enamel Finish; G[, [\_\_\_\_\_]]

## ]1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging.[ Strap knock-down frames in bundles.][ Provide temporary steel spreaders securely fastened to the bottom of each welded frame.] Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

## 2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00 DOOR HARDWARE. Undercut where indicated. Provide exterior doors with top edge closed flush and sealed to prevent water intrusion. Provide doors at 1-3/4 inch thick, unless otherwise indicated. Provide door material that uses a minimum of 25 percent recycled content. Provide data indicating percentage of recycled content for steel door product.[ Provide exterior glazing in accordance with ASTM F2248 and ASTM E1300.][ Exterior doors must be tested in accordance with ASTM F2247 or ASTM F2927 to meet requirements of UFC 4-010-01.]

## 2.1.1 Classification - Level, Performance, Model

### 2.1.1.1 Standard Duty Doors

SDI/DOOR A250.8, Level 1, physical performance Level C, Model [1] [2], of size(s) and design(s) indicated and core construction as required by the manufacturer. Provide [where shown] [for doors No. [\_\_\_\_]].

### 2.1.1.2 Heavy Duty Doors

SDI/DOOR A250.8, Level 2, physical performance Level B, Model [1][2], with core construction as required by the manufacturer [for interior doors] [ and ] [for exterior doors], of size(s) and design(s) indicated.[ Where vertical stiffener cores are required, the space between the stiffeners must be filled with board insulation.][ Provide Level 2 [where indicated] [for doors No. [\_\_\_\_]].]

### 2.1.1.3 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model [1][2][3] with core construction as required by the manufacturer [for interior doors] [ and ] [for indicated exterior doors], of size(s) and design(s) indicated.[ Where vertical stiffener cores are required, the space between the stiffeners must be filled with board insulation.][ Provide Level 3 [where indicated] [for doors No. [\_\_\_\_]].]

### 2.1.1.4 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model [1][2] with core construction as required by the manufacturer [for interior doors] [ and ] [for indicated exterior doors], of size(s) and design(s) indicated.[ Where vertical stiffener cores are required, the space between the stiffeners must be filled with board insulation.][ Provide Level 4 [where indicated] [for doors No. [\_\_\_\_]].]

## [2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. Provide custom steel doors in the door size(s), design(s), materials, construction, gages, and finish as specified for custom steel doors and complying with the requirements of NAAMM HMMA 810. Fill all spaces in exterior doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage.[ Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion.] Prepare doors to receive hardware specified in Section 08 71 00 DOOR HARDWARE.[ Undercut doors where indicated.] Provide doors at 1-3/4 inch thick, unless otherwise indicated.[ Provide exterior glazing in accordance

with ASTM F2248 and ASTM E1300.][ Exterior doors much be tested in accordance with ASTM F2247 and ASTM F2927 to meet the requirements of UFC 4-010-01.]

### ]2.3 INSULATED STEEL DOOR SYSTEMS

Provide insulated steel doors and frames in accordance with SDI/DOOR 113 at entrances to dwelling units and where indicated. Meet energy requirements including Solar Heat Gain Coefficient (SHGC) and U-factor. Provide insulated steel doors with a core of polyurethane foam; face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Provide to doors and frames a phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Test doors in accordance with SDI/DOOR A250.4 and meet the requirements for Level C. Prepare doors to receive specified hardware. Provide doors 1-3/4 inch thick.

### ]2.4 ACCESSORIES

#### 2.4.1 Shelves for Dutch Doors

SDI/DOOR 111. Fabricate shelves of steel not lighter than 16 gage, [[\_\_\_\_\_] inches wide][of the size indicated]. Provide brackets of stock type fabricated of the same metal used to fabricate shelves.

#### 2.4.2 Louvers

##### 2.4.2.1 Interior Louvers

SDI/DOOR 111. Where indicated, provide louvers of stationary [sightproof][ and ][lightproof] type[ where scheduled]. [ Louvers for lightproof must not transmit light.] Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 20 gage steel and louver blades of a minimum 24 gage. [ Louvers for lightproof doors must have minimum of 20 percent net-free opening.][ Sightproof louvers to be inverted ["V" blade design with minimum 55][ and ][inverted ["Y"] blade design with minimum 40] percent net-free opening.]

##### 2.4.2.2 Exterior Louvers

Provide louvers of the inverted ["Y"]["V"]["Z"] type with minimum of [30][55][35] percent net-free opening. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. At louvers provide steel-framed [insect][bird] screens secured to room side and readily removable. Provide [aluminum wire cloth, 18 by 18 or 18 by 16 inch mesh, for insect screens][galvanized steel, 1/2 by 1/2 inch mesh hardware cloth, for bird screens]. Net-free louver area to be before screening.

#### 2.4.3 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors.

#### 2.4.4 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings.

## 2.5 INSULATION CORES

Provide insulating cores at all exterior doors [ and other specific doors noted in the door schedule ], and provide an apparent U-factor of .48 in accordance with [SDI/DOOR 113](#) and conforming to:

- a. Rigid Cellular Polyisocyanurate Foam: [ASTM C591](#), Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with [ASTM D2863](#); or
- b. Rigid Polystyrene Foam Board: [ASTM C578](#), Type I or II; or
- c. Mineral board: [ASTM C612](#), Type I.

## 2.6 STANDARD STEEL FRAMES

[SDI/DOOR A250.8](#), Level [1][2][3][4], except as otherwise specified. Form frames to sizes and shapes indicated, with [welded corners] [ or ] [knock-down field-assembled corners]. Provide steel frames for doors, [transoms,] [sidelights,] [mullions,] [cased openings,] [ and ] [interior glazed panels,] unless otherwise indicated. Provide frame product that uses a minimum of 25 percent recycled content. Provide data indicating percentage of [recycled content for steel frame product](#).

### 2.6.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, [AWS D1.1/D1.1M](#) and in accordance with the practice specified by the producer of the metal being welded.

### [2.6.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

### ]2.6.3 Mullions and Transom Bars

Provide mullions and transom bars of closed or tubular construction with heads and jambs butt-welded together [ or knock-down for field assembly ]. Bottom of door mullions must have adjustable floor anchors and spreader connections.

### 2.6.4 Stops and Beads

Provide form and loose stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or

concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

#### 2.6.5 Terminated Stops

Where indicated, terminate interior door frame stops 6 inch above floor. [ Do not terminate stops of frames for [lightproof,] [soundproof,] [or lead-lined] doors.]

#### 2.6.6 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

#### 2.6.7 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated not lighter than 18 gage.

##### 2.6.7.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened [to wood studs with nails,] [to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding];
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111; and
- d. Solid plaster partitions: Secure anchors solidly to back of frames and tie into the lath. Provide adjustable top strut anchors on each side of frame for fastening to structural members or ceiling construction above. Provide size and type of strut anchors as recommended by the frame manufacturer.

##### 2.6.7.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. [ Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.]

#### 2.7 FIRE [AND] [SMOKE] DOORS AND FRAMES

Provide fire [ and smoke] doors and frames in accordance with NFPA 80 [ and ] [ NFPA 105] and this specification. [ Include insulated core materials in fire doors where indicated in the door schedule.]

##### 2.7.1 Labels

Provide fire doors and frames bearing the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing must be in accordance with NFPA 252 or UL 10C. Provide labels that are metal with raised letters, bearing the name or file number of the door and frame manufacturer. Labels must be permanently affixed at the factory to frames and to the hinge edge of the door. Do not paint door and labels.

#### 2.7.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

#### 2.7.3 Astragal on Fire [and Smoke] Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. [On smoke control doors, conform to NFPA 105.]

#### 2.8 EXTERIOR FRAMES

Provide thermal insulation in all exterior frames. Provide frames of a minimum Level 4, with frames of a minimum thickness of 0.067 inch, 14 gage.

#### 2.9 HARDWARE PREPARATION

Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Punch door frames[, with the exception of frames that will have weatherstripping [or] [lightproof] [or] [soundproof] gasketing,] to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

#### 2.10 FINISHES

##### [2.10.1 Factory-Primed Finish

Thoroughly clean all surfaces of doors and frames then chemically treat and factory prime with a rust inhibiting coating as specified in SDI/DOOR A250.8 [.] [, or paintable A25 galvanized steel without primer. Where coating is removed by welding, apply touchup of factory primer.]

##### ] [2.10.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate [exterior][interior][scheduled] doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924M and ASTM A653/A653M. The coating weight must meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8. [Provide for [exterior doors][ and ][interior doors][door openings No. [\_\_\_\_]]].



### ]2.10.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with [ASTM A879/A879M](#), Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in [SDI/DOOR A250.8](#).

### [2.10.4 Factory-Applied Enamel Finish

Provide coatings that meet test procedures and acceptance criteria in accordance with [SDI/DOOR A250.3](#). After factory priming, apply [one coat] [two coats] of [low-gloss] [medium-gloss] enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements must be in accordance with the coating manufacturer's recommendations. Provide finish coat color(s) [as indicated] [\_\_\_\_\_] to match approved color sample(s).

### ]2.11 FABRICATION AND WORKMANSHIP

Provide finished doors and frames that are strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Provide molded members that are clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints must be well formed and in true alignment. Conceal fastenings where practicable. [ Frames for use in solid plaster partitions must be welded construction. ] [ On wraparound frames for masonry partitions, provide a throat opening 1/8 inch larger than the actual masonry thickness. ] [ Design [ other ] frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound. ]

### 2.12 PROVISIONS FOR GLAZING

Materials are specified in Section [08 81 00](#), GLAZING.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Frames

Set frames in accordance with [SDI/DOOR A250.11](#). Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. [ Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. ]

#### 3.1.2 Doors

Hang doors in accordance with clearances specified in [SDI/DOOR A250.8](#). After erection and glazing, clean and adjust hardware.

#### 3.1.3 Fire [and Smoke] Doors and Frames

Install fire doors and frames, including hardware, in accordance with [NFPA 80](#). [ Install [ fire rated ] smoke doors and frames in accordance with [ [NFPA 80](#) ] [ and ] [ [NFPA 105](#) ]. ]

### 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

### 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

## SECTION 08 11 16

## ALUMINUM DOORS AND FRAMES

05/17, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (2017a) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-6 2021; Addenda AS-BF 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B209M (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B221M (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods,

## Wire, Profiles, and Tubes (Metric)

ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F1643	(2012) Standard Test Methods for Detention Sliding Door Locking Device Assembly
ASTM F2247	(2018) Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Load Method)
ASTM F2927	(2012) Standard Test Method for Door Systems Subject to Airblast Loadings

## NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2020) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

## 1.2 PERFORMANCE REQUIREMENTS

## 1.2.1 Structural Calculations

## 1.2.1.1 Minimum Antiterrorism Performance

Provide doors meeting the minimum antiterrorism performance as specified in the paragraphs below.

- [ a. Dynamic Design Analysis Method

As an alternative to the static equivalent load design approach described above, glazed opening framing members, anchors, and glazing may be designed using a dynamic analysis to prove the glazed opening system will provide performance equivalent to or better than a very low hazard rating in accordance with [ASTM F1642/F1642M](#) associated with the applicable low level of protection for the project.

] [[a] [b]. [Standard Airblast Test Method](#)

Testing in accordance with [ASTM F2927](#) may be by shock tube or arena test. Perform the test on the entire proposed door assembly, which must include, but not be limited to, the glazing, its framing/support system, operating devices, and all anchorage devices. Install door system anchorage that replicates the method of installation to be used for the project. Utilize the fasteners and anchorage methods used to attach the tested door assembly that are representative of the actual door installation. Demonstrate by calculation any deviations in actual installation of the connections or the connected elements from those tested to provide the damage level as indicated below.

The minimum airblast loading parameters for the test must be as follows: peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi); and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec).

The acceptance criteria for the proposed door systems, as determined by the damage level/door response damage criteria of [[ASTM F2247](#)] [[ASTM F2927](#)], will provide a performance equivalent to or better than a category [IV]; [III]; [\_\_\_\_\_] door damage level rating. [ Door glazing performance must be equivalent to or better than [H3- Very Low] [H4-Low] hazard rating in accordance with [ASTM F1642/F1642M](#).]

] [1.2.2 [Wind Borne Debris](#)

Provide impact resistant door [\_\_\_\_\_] assemblies meeting the Windborne-Debris-Impact Resistant Performance requirements of [ASTM E1996](#) and [ASTM E1886](#) as follows:

- (1) Pass missile-impact tests when tested according to [ASTM E1886](#) and meeting performance requirements according to [ASTM E1996](#) for missiles A and D in Table 2.

] 1.2.3 [Air Infiltration](#)

When tested in accordance with [ASTM E283](#), air infiltration per door leaf cannot exceed 0.6 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot.

1.2.4 [Water Penetration](#)

When tested in accordance with [ASTM E331](#), there can be no water penetration at a pressure of 2.86 pounds per square foot of fixed area.

1.2.5 [Thermal Transmittance, Solar Heat Gain, Visible Light Transmittance](#)

Provide products bearing [NFRC Project Label Certificates for Fenestration](#) verifying compliance with requirements for each assembly indicated. An NFRC Bid Report, or approved equal, for field assembled exterior doors may

be submitted in lieu of Project Label Certificates for Fenestration if such reports are created in accordance with NFRC CAMP procedures and are provided by the manufacturer. Such alternate reports may be submitted with shop drawings, however, NFRC validated Project Label Certificates for Fenestration are required as a Closeout Submittal. Contact NFRC for information on [NFRC 100](#) and [NFRC 200](#) Compliance and Monitoring Program (CAMP) rating requirements:

<http://www.nfrc.org/industry/certification/compliance-and-monitoring-program-camp/>

#### 1.2.5.1 U-Factor

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the NFRC as having a whole window U-factor of [\_\_\_\_\_] or less as determined in accordance with [ASHRAE 90.1 - IP](#) and as verified in accordance with [NFRC 100](#).

#### 1.2.5.2 Solar Heat Gain Coefficient (SHGC)

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the National Fenestration Rating Council with a whole window SHGC of [\_\_\_\_\_] or less as determined in accordance with [ASHRAE 90.1 - IP](#) and as verified in accordance with [NFRC 200](#).

#### 1.2.5.3 Visible Light Transmittance (VLT)

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the NFRC with a whole window VLT of [\_\_\_\_\_] or greater as determined in accordance with [ASHRAE 90.1 - IP](#) and as verified in accordance with [NFRC 200](#).

#### [1.2.5.4 Doors with Less than 50 Percent Glazed Area

For exterior aluminum entrances doors with less than 50 percent glazed area, the glazed area is considered the fenestration area and must be certified by the National Fenestration Rating Council with a whole window U-Factor, SHGC and VLT as required above.

### ]1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

For Each Type of Door and Frame Assembly; G[, [\_\_\_\_\_] ]

#### SD-03 Product Data

For Each Type of Door and Frame Assembly; G[, [\_\_\_\_\_] ]

Recycled Content of Aluminum Material; S

#### SD-04 Samples

Finish Samples; G[, [\_\_\_\_\_]]

#### SD-05 Design Data

[ Design Analysis; G[, [\_\_\_\_\_]]  
] Structural Calculations for Deflection and Antiterrorism; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Air Infiltration; G[, [\_\_\_\_\_]]  
Water Penetration; G[, [\_\_\_\_\_]]  
[ Standard Airblast; G[, [\_\_\_\_\_]]  
]

#### SD-07 Certificates

NFRC Project Label Certificates for Fenestration; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Installation of Each Type of Door and Frame Assembly; G[, [\_\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Adjustments, Cleaning, and Maintenance; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

NFRC Project Label Certificates for Fenestration; G[, [\_\_\_\_\_]]

### 1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on non-absorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which caulking and glazing compounds must adhere.

### 1.5 QUALITY CONTROL

#### 1.5.1 Shop Drawing

Indicate elevations and sections for each type of door and frame assembly. Show sizes and details of each assembly, frame construction, [subframe attachment,] thickness and gages of metal, details of door and frame construction, proposed method(s) of anchorage, glazing details, provisions for an location of hardware, [mullion details,] method and materials for flashing and weatherstripping, miscellaneous trim, installation details, and other related items necessary for a complete representation of all components. A qualified blast engineer must perform testing or calculations for door system design resistance to specified blast loads.

#### 1.5.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.

#### [1.5.3 Design Analysis

Submit design analysis with calculations showing that the design of each different size and type of door unit [\_\_\_\_\_] and its anchorage to the structure meets the minimum antiterrorism standards required by paragraph MINIMUM ANTITERRORISM PERFORMANCE[, unless conformance is demonstrated by standard blast test results]. Calculations verifying the performance of each door [\_\_\_\_\_] proposed for use, under the given loads, must be prepared and signed by a registered Professional Engineer. The door [\_\_\_\_\_] components and anchorage devices to the structure, as determined by the design analysis, must be reflected in the shop drawings.

#### ]1.5.4 Test Reports

Test door assembly [including glazing ] for evaluation of hazards generated from airblast loading in accordance with [ASTM F2247] [ASTM F2927] by an independent testing agency regularly engaged in blast testing. This test method and the resulting data are valid for the door size tested and smaller doors of identical construction.

[ Design Door assembly (including glazing) using a dynamic analysis to prove the performance equivalent to or better than a category [IV]; [III]; [\_\_\_\_\_] door damage level in accordance with ASTM F2927 for the peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi); and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). Use a triangular blast load using the applicable pressure and impulse identified above.

] [For minimum Antiterrorism doors [\_\_\_\_\_] , in lieu of a Design Analysis, submit results of standard blast testing, included in a test report, providing information in accordance with [ASTM F2247] [ASTM F2927], as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each door [\_\_\_\_\_] proposed for use to withstand the blast loading parameters and achieve the damage [hazard] level rating specified in paragraph TESTING.

] [Testing in accordance with ASTM F2927 may be by shock tube or arena test. Perform the test on the entire proposed door assembly, which must include, but not be limited to, the glazing, its framing/support system, operating devices, and all anchorage devices. Install door system anchorage that replicates the method of installation to be used for the project. Utilize the fasteners and anchorage methods used to attach the tested door assembly that are representative of the actual door installation. Demonstrate by calculation any deviations in actual installation of the connections or the connected elements from those tested to provide the damage level as indicated below.

The minimum airblast loading parameters for the test must be as follows: peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi); and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec).

] The acceptance criteria for the proposed door systems, as determined by the damage level/door response damage criterion of [ASTM F2247] [ASTM F2927], will provide a performance equivalent to or better than a category [IV];



[III]; [\_\_\_\_\_] door damage level rating. [ Door glazing performance must be equivalent to or better than [H3 - Very low] [H4 - Low] hazard rating in accordance with [ASTM F1643](#).]

#### 1.5.5 Operation and Maintenance Data

Submit detailed instructions for installation, [adjustments](#), [cleaning](#), and [maintenance](#) of each type of assembly indicated.

### 1.6 QUALITY ASSURANCE

#### 1.6.1 Engineer Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years' experience performing blast design. The engineering firm performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

## PART 2 PRODUCTS

### 2.1 DOORS AND FRAMES

Provide swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members[, subframes][, transoms][, adjoining side lites] , trim, and accessories. [ Coordinate side lites, window walls, adjacent curtainwall with Section [08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS](#)] [ and Section [08 44 00 CURTAIN WALL AND GLAZED ASSEMBLIES](#).]

### 2.2 MATERIALS

#### 2.2.1 Anchors

Stainless steel [or steel with hot-dipped galvanized finish].

#### 2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

#### 2.2.3 Aluminum Alloy for Doors and Frames

[ASTM B221M](#), [ASTM B221](#), Alloy 6063-T5 for extrusions. [ASTM B209M](#), [ASTM B209](#), alloy and temper best suited for aluminum sheets and strips. Provide aluminum materials that include a minimum of 30 percent recycled content. Provide data indicating percentage of [recycled content of aluminum material](#).

#### 2.2.4 Fasteners

Hard aluminum or stainless steel.

#### 2.2.5 Structural Steel

[ASTM A36/A36M](#).

#### 2.2.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

## 2.3 FABRICATION

### 2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches on center. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

### 2.3.2 Aluminum Doors

Of type, size, and design indicated and minimum 1-3/4 inch thick. minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal; include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. [ Provide bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges. ] [ Provide double-acting doors rounded edges at hinge stile, lock stile, and meeting stile edges. ]

#### 2.3.2.1 Full Glazed Stile and Rail Doors

Provide doors with [narrow] [medium] [wide] stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

#### 2.3.2.2 Flush Doors

Use facing sheets with [ a vertical ribbed ] [ an embossed ] [ or ] [ a plain smooth ] surface. Use one of the following constructions:

- a. A phenolic resin-impregnated kraft paper honeycomb core, surrounded at edges and around glass and louvered areas with extruded aluminum shapes. Provide cores with a minimum impregnation of 18 percent resin content. Provide sheet aluminum door facings minimum 0.032 inch thick laminated to a 0.10 inch thick tempered hardboard backing, with the backing bonded to the honeycomb core. Bond facing sheets to cores under heat and pressure with thermosetting adhesive and mechanically lock to extruded edge members.
- b. A phenolic resin-impregnated kraft paper honeycomb core. Use aluminum facing sheets minimum 0.050 inch thick and form into two pans to eliminate seams on faces. Bond honeycomb core to face sheets using epoxy resin or contact cement-type adhesive.
- c. A solid fibrous core, surrounded at edges and around glass and louvered areas and cross braced at intermediate points with extruded aluminum shapes. Use aluminum facing sheets of minimum 0.050 inch thickness. Bond facing sheets to core under heat and pressure with a thermosetting adhesive, and mechanically lock to the extruded edge members.
- d. Form from extruded tubular stiles and rails mitered at corners,

reinforce, and continuously weld at miters. Provide facing sheets of minimum 0.032 inch thick sheet aluminum internally reinforced with aluminum channels or Z-bars placed horizontally not more than 16 inch apart and extending the full width of panels. Fit spaces between reinforcing with sound-deadening insulation. Weld facing sheets to reinforcing bars or channels and to stiles and rails. Finish facing sheets flush with faces of stiles and rails.

- e. Form from an internal grid composed of extruded aluminum tubular sections. Provide tubular sections at all sides and perimeter of louver and glass openings. Provide three extruded aluminum tubular sections at top and bottom of each door. Provide wall thickness of tubular sections minimum 0.09 inch except at lock rails which must be minimum 0.125 inch thick, hinge lock rails which must be minimum 0.125 inch thick, and hinge rail edges which must be minimum 0.19 inch thick. Fill spaces in door with mineral insulation. Provide facing sheets of aluminum minimum 0.09 inch thick.
- f. Form from extruded aluminum members at top and bottom, both sides, and at perimeters of louver and glass openings. Provide wall sections of extruded aluminum members minimum 0.09 inch thick and reinforce for application of hardware. Cover framing members on both sides with aluminum facing sheets minimum 0.064 inch thick. Fill door panels with [25 pounds per square inch density polystyrene] [2.5 pound per cubic foot density, chlorofluorocarbon (CFC) free, foamed urethane] with a flame spread rating of no more than 25.

#### 2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and must have countersunk heads. Weld concealed reinforcements for hardware in place.

#### 2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping must be replaceable without special tools, and adjustable at meeting rails of pairs of doors. During installation, verify doors swing freely and close positively. Refer to paragraph AIR INFILTRATION for air leakage requirements and testing.

#### 2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. [ Where indicated, reinforce vertical mullions with structural steel members of sufficient length to extend up to the overhead structural slab or framing and secure thereto. ] [ Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. ] Place anchors [as indicated] [near top and bottom of each jamb and at intermediate points not more than 25 inch apart].

#### 2.3.6 Provisions for Hardware

Coordinate with Section 08 71 00 DOOR HARDWARE. Deliver hardware templates

and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws. [ Provide reinforcement in core of flush doors as required to receive locks, door closers, and other hardware.]

### 2.3.7 Provisions for Glazing

[Provide extruded aluminum snap-in glazing beads on interior side of doors.] [Provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors.] [ Provide glazing beads with vinyl insert glazing gaskets.] [ Design glazing beads to receive thickness indicated for each glazed assembly.] Coordinate requirements with Section 08 81 00 GLAZING.

### 2.3.8 Finishes

Provide exposed aluminum surfaces with [mill finish] [factory finish of anodic coating or organic coating].

#### 2.3.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45. Provide [clear (natural), designation AA-M10-C22-A31, Architectural Class II 0.4 mil to 0.7 mil] [clear (natural), designation AA-M10-C22-A41, Architectural Class I 0.7 mil or thicker] [integral color-anodized, designation AA-M10-C22-A32, Architectural Class II 0.4 mil to 0.7 mil] [integral color-anodized, designation AA-M10-C22-A42, Architectural Class I 0.7 mil or thicker] [ electrolytically deposited color-anodized, designation AA-M10-C22-A34, Architectural Class II 0.4 mil to 0.7 mil] [electrolytically deposited color-anodized, designation AA-M10-C22-A44, Architectural Class I 0.7 mil or thicker] finish. [ Provide material(s) in color(s) [\_\_\_\_\_] [as indicated] [as selected from manufacturer's [standard] [complete] range of color options]].

#### 2.3.8.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide [a baked enamel finish in accordance with AAMA 2603 with total dry film thickness minimum 0.8 mil ] [a high-performance finish in accordance with AAMA 2604 with total dry film thickness of minimum 1.2 mils]. Finish color to be [\_\_\_\_\_] [as indicated] [as selected from manufacturer's [standard] [complete] range of color options].

## PART 3 EXECUTION

### 3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors[, transoms][, adjoining side lites][, and][, adjoining window walls]. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions and the approved shop drawings. Install anchorage that complies with applicable structural requirements. Anchor bottom of each frame to rough floor construction with 3/32 inch thick minimum stainless steel angle clips secured to back of each jamb and

to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Hang doors to produce clearances specified in paragraph ALUMINUM DOORS. After erection and glazing, adjust doors and hardware to operate properly.

### 3.2 PROTECTION FROM DISSIMILAR MATERIALS

#### 3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact to dissimilar metals.

##### 3.2.1.1 Protection

Provide one of the following systems to protect surfaces in contact with dissimilar metals:

- a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
- b. Apply elastomeric sealant between aluminum and dissimilar metals in accordance with Section 07 92 00 JOINT SEALANTS.
- c. Paint dissimilar metals with one coat of primer and one coat of aluminum paint.
- d. Use a non-absorptive tape or gasket in permanently dry locations.

#### 3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint to prevent aluminum discoloration.

#### 3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

#### 3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting aluminum, paint the wood or other absorptive surface with two coats of aluminum paint and seal joints with elastomeric sealant.

### 3.3 SEALING AROUND ASSEMBLIES

Seal all penetrations of the air barrier by sealing around door openings as necessary to achieve compliance with air leakage requirements indicated in [the air barrier sections of the specifications] [, the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM] [, and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS]. Flash all doors with corrosion resistant flashing to prevent water intrusion.

### 3.4 CLEANING

Upon completion of installation, clean door and frame surfaces in

accordance with door manufacturer's written recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

### 3.5 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

## SECTION 08 11 69

## METAL STORM DOORS

02/10

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

## ASTM INTERNATIONAL (ASTM)

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Storm doors

Show elevations of storm door units, full-size section,

thicknesses and gages of material, finish and color, fastenings, methods of anchorage, size and spacing of anchors, method of glazing, locations of operating hardware, method and material for weatherstripping, method of attaching and operating both screen and glass insert panels, details of installation, and connections with other work.

On storm door schedule, show location of each unit.

#### SD-03 Product Data

##### Storm doors

##### Hardware

Submit complete descriptive literature for each type of storm door and accessory.

#### SD-04 Samples

[ Storm doors]

[ Submit one complete door unit of each type for approval. Label the sample for identification and, if approved, forward to the site. Samples in good condition may be installed if clearly identified and the locations are recorded. Do not remove identification and approval marks until final acceptance.]

[ Submit one full-sized corner at least 6 inches long and 3 inches wide; show construction of each type frame.]

Storm door finishes; G[, [\_\_\_\_]]

Submit for approval color range samples for color finishes. The actual finish shall be within the range represented by the approved samples.

#### SD-06 Test Reports

##### Storm doors

Submit test reports indicating that storm doors conform to applicable requirements specified herein.

#### SD-10 Operation and Maintenance Data

Storm doors, Data Package 1; ; G[, [\_\_\_\_]]

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Carefully pack products in poly bags or other protective containers. Deliver products to the project site in undamaged condition, store out of contact with the ground under weathertight covering, and protect against damage. Do not install damaged units. Replace damaged units with new units.



## PART 2 PRODUCTS

## 2.1 MATERIALS

Metal storm doors shall be either aluminum or steel.

## 2.1.1 Wrought Aluminum, Sheet or Plate

ASTM B209, Alloy 3000 or 5000 series.

## 2.1.2 Extruded Aluminum

ASTM B221, Alloy 6063 or 6463, Temper T5 or T6.

## 2.1.3 Steel

Sections of the door shall be of roll formed tubular lock seam construction, consisting of 22 gage, hot-dipped galvanized steel.

## 2.1.4 Storm Doors

Conform to requirements specified herein. Doors shall be self-storing, equal light, combination storm doors, fully assembled and prehung complete with glazing, insect screens, hardware, and weatherstripping ready for installation into prepared door openings. Dimensions indicated are nominal. Field measure openings to obtain exact dimensions needed for fabrication.

## 2.1.4.1 Hardware

For each storm door, provide a spring-loaded latch bolt operated by a turn knob, thumb piece, or lever handle; a tubular, adjustable, pneumatic or hydraulic closer; a chain door stop; and an adjustable sweep mounted on a bottom expander or with a flat metal retainer. Storm doors shall be lockable from the inside. Latch hardware, latch pin, knob, and springs shall be made from corrosion resistant materials.

## 2.1.4.2 Door Frames

Expander type, regular Z-bar, or New England Z-bar, as required to suit actual conditions at the door openings.

## 2.1.4.3 Door Stiles and Rails

Aluminum storm doors shall have extruded aluminum tubular sections not less than one inch deep by 2 1/4 inches face dimension, or 1 1/2 inches deep by 2 inches face dimension, and 0.050 inch nominal wall thickness. Steel storm doors shall have roll formed tubular lock seam steel sections with corners reinforced with 16 gage steel internal reinforcement and edge brazed.

## 2.1.4.4 Kick Plate

Kick plates for aluminum doors shall be not less than 3/16 inch thick extruded aluminum or 5/16 inch thick sandwich panel with sheet aluminum on both sides. Kick plates for steel doors shall be an embossed 18 gage galvanized steel panel. Panels shall be complete with vinyl splines and/or channel glazing stops with screws for installation.

## 2.1.4.5 Screen

Screen cloth shall be [16 by 18 mesh aluminum or fiberglass] [304 stainless steel, 12 by 12 mesh and wire diameter of .028 inch]. [Aluminum and fiberglass cloth screen inserts shall be held in place with removable, laid-in glazing splines.] [Stainless steel security screen shall be held in place by continuous 18 gage galvanized steel retainer angles fastened with cadmium or zinc-plated screws 4 inches on center. The main frame of the security screen shall be constructed of 24 gage hot-dipped galvanized steel with lock seam construction.]

#### 2.1.5 Sealant

Elastomeric type, ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT, Color [\_\_\_\_\_]. Sealant shall have been tested and approved for use with aluminum, steel, and wood.

### 2.2 COMPONENTS

#### 2.2.1 Connections

Rigidly connect frames at corners to prevent racking during normal handling and installation.

#### 2.2.2 Glass Inserts

Provide glaze inserts using either marine or drop-in glazing. Inserts for steel doors shall be of mitered joint construction and brazed at exterior corners. Glass shall be in accordance with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (transparent), Quality q3, not less than 1/8 inch thick.

#### 2.2.3 Locks

On inserts, locks shall engage round holes or deep notches in the main frame.

### 2.3 FINISHES

#### 2.3.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating or organic coating. New storm doors shall have the same finish.

##### 2.3.1.1 Anodic Coating

Exposed surfaces of aluminum extrusions and sheets shall be cleaned, and an anodized finish shall be applied conforming to AA DAF45. Finish shall be [clear (natural), designation AA-M10-C22-A31, Architectural Class II, AAMA 611] [integral color anodized, designation AA-M10-C22-A32, Architectural Class II, AAMA 611, or electrolytically deposited color anodized, designation AA-M10-C22-A34, Architectural Class II, AAMA 611. Color shall be [as indicated] [\_\_\_\_\_]].

##### 2.3.1.2 Organic Coating

Exposed surfaces of aluminum extrusions and sheets shall be thoroughly cleaned and primed, and a baked enamel finish shall be applied conforming to AAMA 2603, with total dry film thickness not less than 0.8 mil. The finish color shall be [white] [as indicated] [\_\_\_\_\_].

### 2.3.2 Steel

Parts formed from hot-dipped galvanized steel shall be bonderized before and after assembly. After fabrication and assembly, materials shall be finished with a baked enamel finish. Color shall be [\_\_\_\_\_] [as indicated] [as selected from manufacturer's chart].

## PART 3 EXECUTION

### 3.1 PREPARATION

Thoroughly clean and repair surfaces to which storm door frames will be applied.

### 3.2 INSTALLATION

Install square, in a true plane, level, plumb, in alignment with adjacent construction, and in accordance with manufacturer's printed directions.

#### 3.2.1 Sealants

Make the entire perimeter of the main frame weathertight. Provide gaskets to separate new metal from existing metal.

#### 3.2.2 Fastening

Attach units with panhead screws of adequate dimensions for the particular installation.

### 3.3 CLEANING

After installation, clean exposed surfaces to remove foreign matter and surface blemishes. Remove damaged units and units which cannot be cleaned satisfactorily and provide new units.

-- End of Section --

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## SECTION 08 11 73

## SLIDING FIRE DOORS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C1036 (2021) Standard Specification for Flat Glass

## FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide  
<http://www.approvalguide.com/>

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA MG 1 (2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
UNDERWRITERS LABORATORIES (UL)	
UL 9	(2009; Reprint Mar 2020) Standard for Fire Tests of Window Assemblies
UL 10A	(2009; Reprint Mar 2022) UL Standard for Safety Tin-Clad Fire Doors
UL 10B	(2008; Reprint May 2020) Fire Tests of Door Assemblies
UL 14B	(2008; Reprint Sep 2021) UL Standard for Safety Sliding Hardware for Standard, Horizontally Mounted Tin-Clad Fire Doors
UL 33	(2010; Reprint Apr 2020) Heat Responsive Links for Fire-Protection Service
UL 228	(2006; Reprint Mar 2022) UL Standard for Safety Door Closers-Holders, With or Without Integral Smoke Detectors
UL 325	(2017; Reprint Feb 2020) UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Sliding Fire Doors; G[, [\_\_\_\_\_]]

### SD-03 Product Data

Sliding Fire Doors; G[, [\_\_\_\_\_]]

Electrical Work; G[, [\_\_\_\_\_]]

### SD-08 Manufacturer's Instructions

Sliding Fire Doors

### SD-10 Operation and Maintenance Data

Sliding Fire Doors, Data Package 2; ; G[, [\_\_\_\_\_]]

#### 1.2.1 Shop Drawing Information

Submit drawings for all sliding fire doors. Show types, sizes, location,

metal gages, hardware, installation details, and other details of construction. [ For motor-operated doors, include supporting brackets for motors, location, type, ratings of motors, and safety devices. Submit wiring diagrams for motors and controls.]

### 1.3 DELIVERY AND STORAGE

Deliver fire doors to the job site wrapped in a protective covering bearing manufacturer's name and brand. Store doors in dry locations with adequate ventilation, free from dust or water, and in such a manner to permit access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

## PART 2 PRODUCTS

### 2.1 SLIDING FIRE DOORS

Conform to NFPA 80, UL 10B, and the requirements specified herein, and must be listed (labeled). Provide doors complete with operating devices, hardware, and accessories.

### 2.2 FABRICATION

Provide one of the following types:

#### 2.2.1 Steel-Covered Composite

Flush panel consisting of a manufactured core material, such as calcium-silicate block insulation, covered on both faces with a bonded steel sheet not lighter than 20 gage and on edges with a steel perimeter channel not lighter than 18 gage. Door panel edges must be encased in a steel channel not lighter than 14 gage. All joints in face sheets must be backed by an interior steel "H" column and covered with a steel, surface-applied faceplate or adequately reinforced panels at connecting joints to provide a solid one piece unit when installed.

#### 2.2.2 Hollow-Metal

Flush panel consisting of a resin-impregnated, kraft honeycomb core covered on both faces with a bonded steel sheet not lighter than [ 20 gage for door openings up to and including 10 feet in height] [ and ] [ 18 gage for door openings over 10 feet in height] and on edges with a steel perimeter channel not lighter than 18 gage. Door panel edges must be encased in a steel channel not lighter than 14 gage. All joints in face sheets must be backed by an interior steel "H" column and covered with a steel, surface-applied faceplate or adequately reinforced panels at connecting joints to provide a solid one piece unit when installed.

#### 2.2.3 Corrugated Sheet Metal

Approximately 2 1/2 inches thick consisting of two galvanized corrugated steel sheets not lighter than 22 gage each sheet. The corrugations must be approximately 2 1/2 inches on centers and must run vertically on one side of the door and horizontally on the other. A 1/16 inch thick layer of noncombustible insulation material must be provided between the sheets. Provide steel frame composed of structural steel shapes at all edges of door leaves. Secure frame to corrugated sheets by through bolting or by welding.

#### 2.2.4 Tin-Clad

Conform to [UL 10A](#). Door must have a core made up of layers of boards nailed to each other and encased in terne- or zinc-coated plates that are jointed together at their edges with nails driven through the joints into the core.

### 2.3 OPERATION

[Single-slide ] [Center-parting ] on [level] [inclined] tracks normally [closed] [open with automatic closing system of UL labeled [reel type] [ or ] [weight type with weight box of sheet steel not lighter than 16 gage. Provide continuous length weight box for the entire travel of the weights.] [ Provide fusible links as required by [NFPA 80](#) to activate at 160 degrees F.] [ Provide manually operated doors capable of being operated with a force of 45 pounds.] [ Provide [pneumatic] [electric] operators conforming to [NFPA 80](#) and the requirements specified herein and a UL or ( [FM APP GUIDE](#)) listed releasing device to permit automatic closing in case of power failure.] Provide safety edges to reverse direction of doors when an obstruction is encountered and limit switches to stop the doors in the fully open or fully closed position. Operators, holders, and release devices must conform to [UL 228](#) and [UL 325](#) and be listed (labeled).] [ Operating devices for use on door No. [\_\_\_\_\_] must conform to Article 500 - of [NFPA 70](#), Class [\_\_\_\_\_] , Group [\_\_\_\_\_] , Division [\_\_\_\_\_] .]

#### [2.3.1 Pneumatic Operators

Heavy-duty type designed to operate door at one foot per second with air pressure of [\_\_\_\_\_] psi. Operator must open, close, start, and stop the door smoothly. Control equipment must be [electrical conforming to [NEMA ICS 1](#) and [NEMA ICS 2](#); enclosures must be [NEMA ICS 6](#), Type 12,] [pneumatic] [pushbutton wall switches] [ceiling pull switches] [roll-over floor treadle] [as indicated] [except that for enclosures for use in the hazardous space indicated as [\_\_\_\_\_] must conform to Article 500 of [NFPA 70](#) ]. [ Provide full-guarded type pushbuttons to prevent accidental operation.]

#### ] 2.3.2 Electric Operators

Heavy-duty type designed to operate door at not less than two-thirds or more than one foot per second. Provide electrical control equipment conforming to [NEMA ICS 1](#) and [NEMA ICS 2](#); enclosures must be [NEMA ICS 6](#), Type 12, [pushbutton wall switches] [ceiling pull switches] [roll-over floor treadle] [as indicated] [except that for enclosures for use in the hazardous space indicated as [\_\_\_\_\_] must conform to Article 500 of [NFPA 70](#) ]. [ Provide full-guarded type pushbuttons to prevent accidental operation.] Provide electric power operators of the type recommended by the door manufacturer and provide complete assembly with motor, controls, limit switches, magnetized reversing contactor, and other necessary accessories. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency operators. Provide the operator with slipping clutch coupling to prevent stalling the motor. Where control voltages differ from motor voltage, provide a control voltage transformer in and as part of the starter. Motors must conform to [NEMA MG 1](#); be high-starting torque, reversible type; be of sufficient horsepower and torque output to move the door in either direction from any position; and produce a door travel speed of not less than two-thirds or more than one foot per second without exceeding the rated capacity. Provide motors rated [\_\_\_\_\_] volts, [\_\_\_\_\_] hertz,



[\_\_\_\_\_] -phase current and suitable for across-the-line magnetic starting. Design all motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Provide door motors with an enclosed, across-the-line type, magnetic reversing contactor having thermal overload protection.

### ]2.3.3 Electrical Work

Conform to NFPA 70. Provide all control devices and all conduit and wiring from the motor to controls necessary for the proper operation of the doors. Electrical wiring for power from the power source to the operators or controls is specified in Division 26. Provide electrical wiring from controls to operators under this section.

## 2.4 HARDWARE

Conform to NFPA 80, UL 14B, and the requirements specified herein, and must be listed (labeled). Design tracks, roller assemblies, and installation hardware to support a dead load to 1-1/2 times the door and attached hardware without deformation which would interfere with the operation of the door. Provide tracks formed of sheet steel not lighter than 14 gage. Provide ball or roller bearing wheels or rollers with case-hardened races on all devices incorporating wheels or rollers. Provide recessed steel pulls on both sides of all door leaves [except for corrugated sheet metal doors which may be surface mounted]. Fusible links must conform to UL 33 and must be listed (labeled).

## 2.5 ACCESSORIES

### 2.5.1 Track Hood

Form of zinc-coated steel not lighter than 18 gage.

### 2.5.2 Glass Lights

UL 9 listed (labeled) and ASTM C1036, Type II, Class I, Form 1, M1 or M2, 1/4 inch thick of size indicated, except that in no case must the size be larger than permitted with the required fire rating.

### 2.5.3 Weather Stripping

Provide on head, jamb, and sills of [exterior doors] [interior doors [\_\_\_\_\_]]. [ Form of 1/16 inch thick fabric-reinforced neoprene. Install using steel continuous retainers.] [ Provide nylon filament brush type in extruded aluminum retainers.]

### 2.5.4 Locking Device

[Provide heavy-duty hasp and staple on doors [\_\_\_\_\_] . Locate on [\_\_\_\_\_] side.] [Provide heavy-duty mortise sliding door locks with [double] [single] pin-tumbler cylinders.]

## 2.6 FINISH

### 2.6.1 Exterior Door[s] [and Interior Door[s]] With Hardware

Steel Surfaces of Exterior Door[s] [and Interior Door[s]] Including Hardware: Provide galvanized finish on all concealed surfaces. Provide a shop-primed galvanized finish on all exposed surfaces. Galvanizing must

conform to [ASTM A653/A653M](#), coating designation [G90](#) for steel sheets and [ASTM A123/A123M](#) for assembled steel products. Clean and coat all galvanized surfaces damaged during fabrication with galvanized repair paint. Prior to receiving primer, thoroughly clean all surfaces and phosphate treat to assure maximum paint adherence. Provide a metallic oxide or synthetic resin primer of the manufacturer's standard type and shall be applied by dipping or spraying.

#### 2.6.2 Steel Surfaces of Interior Door[s] Including Hardware

Provide a shop-primed finish or a galvanized finish on all exposed surfaces. Galvanizing must conform to [ASTM A653/A653M](#), coating designation [G90](#) for steel sheets and [ASTM A123/A123M](#) for assembled steel products. Provide a metallic oxide or synthetic resin primer of the manufacturer's standard type applied by dipping or spraying. Prior to receiving primer, thoroughly clean all surfaces and phosphate treat to assure maximum paint adherence.

### 2.7 LABELS

Provide fire doors bearing labels of the UL or [FM APP GUIDE](#) as evidence of the door[s] conforming to the rating[s] indicated. The construction details necessary to obtain the labels must take precedence over details indicated or specified herein. Labels must be a minimum of [3/4 by 2 inch](#) brass plate with [1/2 inch](#) high raised letters. Label must be permanently attached to the door and must not be painted.

#### 2.7.1 Contractor's Option

In lieu of UL or [FM APP GUIDE](#) labels, the fire doors may bear the label of a nationally recognized testing agency. The testing agency must be adequately equipped and competent to perform services equivalent to the UL inspection and certification program. Copies of the test reports indicating compliance with required ratings must accompany the certificates of compliance.

#### 2.7.2 Oversized Doors

Where fire doors and frames exceed the size for which testing and labeling service is offered, furnish certificates of inspection from the testing laboratory. The certificate must state that the doors, frames, and hardware to be provided are identical in design, materials, and construction to a door that has been tested and rated.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install fire doors in accordance with [NFPA 80](#) and the manufacturer's approved instructions and shop drawings. Doors must be free from warp, twist, or distortion and must be lubricated and properly adjusted to operate freely.

-- End of Section --

## SECTION 08 13 73

## SLIDING METAL DOORS

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B136	(1984; R 2013) Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B137	(1995; R 2021) Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
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- NEMA ICS 6** (1993; R 2016) Industrial Control and Systems: Enclosures
- NEMA MG 1** (2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70** (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
- NFPA 80** (2022) Standard for Fire Doors and Other Opening Protectives

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC Paint 28** (1991; E 2004) Water-Borne Epoxy Primer for Steel Surfaces
- SSPC Paint 36** (2006) Two-Component Weatherable Aliphatic Polyurethane Topcoat, Performance-Based

## U.S. DEPARTMENT OF DEFENSE (DOD)

- MIL-A-8625** (1993; Rev F; Am 1 2003) Anodic Coatings, for Aluminum and Aluminum Alloys

## UNDERWRITERS LABORATORIES (UL)

- UL 10A** (2009; Reprint Mar 2022) UL Standard for Safety Tin-Clad Fire Doors
- UL 14B** (2008; Reprint Sep 2021) UL Standard for Safety Sliding Hardware for Standard, Horizontally Mounted Tin-Clad Fire Doors
- UL 506** (2017; Reprint Jan 2022) UL Standard for Safety Specialty Transformers

## 1.2 SYSTEM DESCRIPTION

Provide **fire doors** conforming to **NFPA 80** and the requirements specified herein. Provide fire doors bearing the Underwriters Laboratories, Warnock Hersey, Factory Mutual, or other nationally recognized testing laboratory label for the required fire rating class and temperature rise classification if applicable. Provide each door with a permanent label showing the manufacturer's name and address and the model number of the door. Doors in excess of the labeled size will be deemed oversize and provided with a certificate signed by an official of the company, certifying that the door and operator have been designed to meet the specified requirements. Provide each door complete with operating devices, hardware, and accessories. Minimum design wind load is [\_\_\_\_\_] psf. Construct doors to sustain a superimposed load, both inward and outward,

equal to 1.5 times the minimum design wind load and not to deflect more than 1/120 of the door width and height. When tested in accordance with the static air pressure test procedure of [ASTM E330/E330M](#), the door must support the superimposed loads for a minimum period of 10 seconds without evidence of serious damage and be operable after conclusion of the tests. As an option, conduct the tests using an equivalent uniform static load. Support the uniform static load test specimen using rollers and track as required for project installation. Recovery must be at least three-fourths of the maximum deflection within 24 hours after the test load is removed.

### 1.2.1 Performance Requirements

[Design Analysis and Calculations](#), equipment and performance data for [Sliding Door Assemblies](#), and [Hardware and Accessories](#) must meet design specifications as required by referenced standards within this section.

#### 1.2.1.1 Door Performance

Provide [[an electrically operated door with manual override mechanism] [a manually operated door], industrial type constructed of [ASTM A36/A36M](#) [structural steel sections] [formed plates] sized for loads specified.] [doors of the [one-way sliding] [and] [biparting double-leaf] type as indicated [supported on recessed rails set in floor with top guides]]. Furnish doors complete with hardware, tracks, guides, and accessories.

#### 1.2.1.2 Biparting Doors

Provide doors requiring operating personnel to walk with leaf as it moves. Each door leaf must have separate drive units, [driving one or more wheels]. Each leaf must have [motor-mounted, spring-set,] [\_\_\_\_\_] [solenoid-released] motor brake. Each leaf must move independently from other leaves. Design leaves of biparting doors as follows:

- a. Exterior windload of [50] [\_\_\_\_\_] psf
- b. Windload deflection not to exceed [\_\_\_\_\_] [the door height in inches divided by 120] [\_\_\_\_\_].
- c. Interior horizontal sliding doors to withstand an internal pressure of [10] [\_\_\_\_\_] psf, both directions.
- d. Door operating speed greater than [30] [\_\_\_\_\_] feet per minute (fpm) and less than [15] [\_\_\_\_\_] fpm is not permitted.

#### 1.2.2 Seal Performance

When pressure is applied to the OPEN button, seals must automatically deflate before doors open. Upon deflation of pressure in each seal, provide switches [connected in series] that energize door-open controller. Every seal must deflate properly before permitting doors to move. Coordinate controls with this operating sequence for seals and door movement. Pressure must keep doors closed and hold center seals tight. When power fails, a braking device will hold each door shut and maintain seals. [Interlock personnel door to prevent movement of the leaf, or group in which it is located, when the personnel door is open.]

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sliding Metal Doors

SD-07 Certificates

Fire Doors

Fabrication Drawings

Installation Drawings

Design Analysis and Calculations

Sliding Door Assemblies

Hardware and Accessories

Doors

Flush Doors

Rails

Paint

1.4 QUALITY ASSURANCE

Submit [Fabrication Drawings](#) with framing member details, welding details, and finish and painting details for sliding door assemblies. Include in the drawings elevations of each door type, details of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of tracks, rollers, power operators, controls, and fittings. Include a schedule showing the location of each door with the drawings, and the manufacturer's catalog data. Provide [Installation Drawings](#) with type and location of hardware, framing details, and rough opening dimensions and details for horizontal door and biparting door systems.

- a. Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to work specified in this section.
- b. Conform to the requirements of Underwriters Laboratories, Inc., for motors, wiring and controls.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the jobsite wrapped in a protective covering, with the brands and names clearly marked thereon. Store doors in an adequately ventilated, dry location that is free from dust, water, or other contaminants and in a manner that permits access for inspection and handling. Handle doors carefully to prevent damage to the faces, edges, and ends. Replace damaged items that cannot be restored to like-new

condition.

#### 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

#### 1.7 MAINTENANCE

Provide manufacturer's installation, operation, and maintenance instructions for [sliding metal doors](#).

### PART 2 PRODUCTS

#### 2.1 DOORS

Provide leaf sections consisting of welded construction. Provide joints to develop 100 percent of the strength of the framing members. Members may be prefabricated for field assembly. When using bolts, conform to [ASTM A325](#) for fastening main members. Bolts conforming to [ASTM A307](#) are permitted for fastening secondary members.

- a. Make vertical members continuous throughout the height of the door. Make members adjoining each other at splices to facilitate field assembly. Provide framing members that are true to dimensions and square in all directions. Leaf out of line in vertical or horizontal plane of the door opening greater than [\[ 1/8 inch in 20 feet \] \[\\_\\_\\_\\_\\_\]](#) is not permitted.
- b. Provide [\[full-depth members\]](#) [\[gusset plates at the one-third points\]](#) for lateral support to all main vertical members. Provide diagonal bracing to support the leaf assembly to withstand shipping, assembly, and operational loads. Provide ground smooth welds.
- c. Fabricate cover sheets from [\[0.050\] inch \[\\_\\_\\_\\_\\_\]](#) thick (minimum) [\[aluminum\] \[\\_\\_\\_\\_\\_\]](#) facing, [\[Alloy 3003\] \[\\_\\_\\_\\_\\_\]](#), meeting [ASTM B209](#) requirements. Provide [\[ribbed\]](#) [\[fluted\]](#) finish. Provide joints of the [\[butt\] \[\\_\\_\\_\\_\\_\]](#) type showing a minimum crack. Reinforce to ensure rigid construction and prevent warping and sagging.
- d. Seal cover sheets with an approved caulking compound. Fasten to frame with corrosion-resistant [\[steel\] \[\\_\\_\\_\\_\\_\]](#) fasteners [\[9\] inch \[\\_\\_\\_\\_\\_\]](#) on center. Where flat sheets are attached as either covering or linear sheets, do not exceed [\[25\] square feet \[\\_\\_\\_\\_\\_\]](#) for unsupported areas.

#### 2.2 PERSONNEL DOORS

Provide manufacturer's standard [flush doors](#) of [\[aluminum type,\] \[\\_\\_\\_\\_\\_\]](#) size as indicated, complete with hardware and airtight seals.

#### 2.3 SLIDING DOORS

Provide sliding doors of the following types:

##### [2.3.1 Steel-Covered Composite

Provide composite fire doors that are [\[\[3 hour\] \[4 hour\] \[\\_\\_\\_\\_\\_\] rated\]](#) [\[as shown on drawings\]](#). Provide flush panel doors consisting of a manufactured core material, such as calcium silicate block or mineral fiberboard

insulation, covered on both faces with a bonded steel sheet not lighter than 20 gauge and covered on edges with a steel perimeter channel not lighter than 18 gauge. Doors may be fabricated using several panels, with panel edges encased in a steel channel not lighter than 14 gauge. Join or back joints in panels by an interior steel H column and cover with a steel-surface applied face plate. Provide fire-rated doors that have a [maximum temperature rise rating of 250 degrees F at 30 minutes] [non-temperature rise rating].

] [2.3.2 Hollow Metal

Provide [[non] [3 hour] [4 hour] [\_\_\_\_\_] rated] doors [as shown on drawings]. Provide flush panel doors consisting of a resin impregnated Kraft honeycomb core covered on both faces with a bonded steel sheet not lighter than 20 gauge and covered on edges with a steel perimeter channel not lighter than 18 gauge. Doors may be fabricated using several panels, with panel edges encased in a steel channel not lighter than 14 gauge. Back joints in face sheets by an interior steel H column and covered with a steel surface applied face plate.

] [2.3.3 Flush Steel Tubular Frame

Provide flush steel tubular frame doors that are [[non] [3 hour] [4 hour] [\_\_\_\_\_] rated] [as shown]. Provide flush panel doors consisting of a 16 gauge steel tubing frame with 18 gauge face sheets with fiberglass core. Provide intermediate stiffeners at 24 inches on center maximum. Spot weld the face sheets to the frame and stiffeners. Door may be fabricated using several panels, with 11 gauge steel splice plates full height on both sides. Provide fire rated doors that have a [maximum temperature rise rating of 250 degrees F at 30 minutes] [non-temperature rise rating].

] [2.3.4 Tin-Clad

Provide tin-clad doors that are [[2-ply [3/4] [1-1/2]] [3-ply [3/4] [1-1/2] [3]] hour rated] [as shown], conforming to UL 10A. Provide hardware conforming to UL 14B. Provide doors having a core made up of layers of 3/4 inch thick wooden boards nailed to each other and encased in tern or zinc plates that are jointed together at their edges with nails through the joints into the core. Doors with 1-1/2 hour and 3 hour rating must have a maximum temperature rise rating of 250 degrees F at 30 minutes.

] [2.3.5 Insulated

[Provide flush panel non-labeled insulated doors consisting of a urethane, polystyrene, or fiberglass insulation core covered on both faces with a bonded steel sheet not lighter than 18 gauge and covered on the edges with a steel perimeter channel not lighter than 18 gauge.] [Provide flush panel labeled [3/4] [1-1/2] [3] [4] hour rated doors consisting of fiberglass insulation core covered on both faces with a bonded steel sheet not lighter than 18 gauge and covered on the edges with a steel perimeter channel not lighter than 18 gauge. Fire rated doors must have a [maximum temperature rise rating of 250 degrees F at 30 minutes] [non-temperature rise rating] [rating as shown]]. Perform door construction to provide a thermal conductance (U-value) of [ 0.15 btu/hr times sq f times f ] [\_\_\_\_\_] . Doors may be fabricated using several panels. Encase panel edges in a steel channel not lighter than 14 gauge. Back joints in face sheets by an interior steel H column and covered with a steel surface-applied face plate. Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.



## ]2.4 OPERATION

Provide doors that are [single-slide] [center-parting] on [level] [inclined] tracks and designed to normally remain in the [open position and close automatically in case of fire] [or] [closed position but permit normal operation for passage]. Doors must be [manually] [power] operated. Automatic closing system must be a [labeled automatic reel type closer] [or] [weight type closer with a weight box fabricated of steel not lighter than 16 gauge]. Provide fusible links as required by **NFPA 80** and activate at 160 degrees F.

## 2.4.1 Power Operators

Provide [pneumatic] [electric] type operator specified herein. Provide both the door and the power actuating device with a UL or FM listed releasing mechanism that will permit the required self-closing feature to function and close the door automatically in case of fire irrespective of power failure or manual operation. Provide readily adjustable limit switches to automatically stop the door in its full open or closed position. Provide operating devices suitable for the Class, Division, and Group shown and as defined in **NFPA 70**.

## [2.4.2 Pneumatic Operators

Provide heavy duty industrial type operator, designed to operate the door at [1] [2] [3] [4] ft per second with air pressure of [\_\_\_\_\_]psi. The operator must open, close, start, and stop the door smoothly. Control must be [[electrical, conforming to **NEMA ICS 2**, Part 8 and **NEMA ICS 6**. Provide enclosures which are Type 12 (industrial use), Type 7 or 9 in hazardous locations,] [pneumatic,] with [push button wall switches.] [ceiling pull switches.] [roll-over floor treadle.]] [as indicated on the drawings.]

## ]2.4.3 Electric Operators

Provide heavy-duty industrial type operator, designed to operate the door at not less than [1] [2] [3] [4] ft per second. Provide [push button wall switches] [ceiling-pull switches] [roll-over floor treadle] electrical controls as indicated. Provide all electrical power operators complete with electric motor, brackets, controls, limit switches, magnetic reversing starter, and all other accessories necessary. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency closing system. Provide the power operator with a slipping clutch coupling or torque limiter, as required to prevent stalling of the motor. Provide operators with provisions for immediate emergency manual operation of the door in case of electrical failure. Where control voltages differ from motor voltage, provide an integrated control voltage transformer as part of the starter. Provide electric control conforming to **NEMA ICS 2**, Part 8 and **NEMA ICS 6** with voltage of 120 volts or less. Provide enclosures of the Type 12 (industrial use), Type 7 or 9 in hazardous locations, [with [push button wall switches.] [ceiling pull switches.] [roll-over floor treadle.]] [as indicated on the drawings.]

## 2.4.3.1 Motors

Provide drive motors conforming to **NEMA MG 1**, have high-starting torque, reversible type, and with sufficient power and torque output to move the door in either direction from any position at the required speed without exceeding the rated capacity. Provide motors suitable for operation on

[\_\_\_\_\_] volts, [60] [\_\_\_\_\_] hertz, [single] [three] phase, and suitable for across-the-line starting. Design motors to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating.

#### 2.4.3.2 Controls

Provide each door motor with thermal overload protection, limit switches, and remote-control switches with control equipment conforming to NEMA ICS 2. Provide NEMA ICS 6 Type 12 (industrial use) enclosures, Type 7 or 9 enclosures in hazardous locations, or as otherwise indicated. Each wall control station must be the three-button type, with the controls marked "OPEN," "CLOSE," and "STOP." When the door is in motion and the "STOP" control is pressed, the door must stop instantly and remain in the stop position; from the stop position. Provide doors operable in either direction by the "OPEN" or "CLOSE" controls. Provide full-guarded controls to prevent accidental operation.

#### 2.4.4 Electrical Work

Provide conduit and wiring necessary for proper operation in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Make flexible connections between doors and fixed supports with extra flexible type SO cable, except in hazardous locations where wiring conforms to NFPA 70. The cable must have spring-loaded automatic take-up reel coil cord or an equivalent and approved device.

#### 2.4.5 Transformer

Conform to UL 506 for control transformers.

### 2.5 HARDWARE

Provide hardware conforming to NFPA 80, UL 14B and the requirements specified herein. Design tracks, roller assemblies, and installation hardware to support a dead load equal to 1.5 times the weight of the door and attached hardware without deformation that would interfere with the operation of the door. Form tracks of galvanized G90 steel not lighter than 14 gauge. Provide ball or roller bearing wheels or rollers with case hardened races on all devices incorporating wheels or rollers. Attach hardware using zinc plated through bolts, nut plates, or similar devices to ensure adequate fastener strength. Provide recessed steel pulls on both sides of all door leaves. Provide closing system for [sliding doors] [and] [sliding fire doors] that is [counterweight closing with weight boxes] [cable reel closer] [controlled speed cable reels].

#### [2.6 RAILS

Provide [steel] [\_\_\_\_\_] rails for horizontal sliding doors of [ 40 pound ] [as indicated].

#### ]2.7 SAFETY DEVICE

The leading edge of doors must have a safety device that will immediately reverse the door movement upon contact with an obstruction and cause the door to return to its full open position. The safety device cannot substitute for a limit switch. Provide exterior doors with a combination weather seal and safety device.

## 2.8 ACCESSORIES

### 2.8.1 Track Hood

Provide zinc-coated steel no lighter than 18 gauge track hood for exterior doors mounted on the exterior face of the wall.

### 2.8.2 Glass Lights

Provide glass lights of the size indicated, except that in no case can the size be larger than that permitted by the required fire rating. Provide glass in accordance with Section 08 81 00 GLAZING.

### 2.8.3 Weatherstripping

Provide weatherstripping on head, jamb, and sills of exterior doors. Provide 1/16 inch thick fabric-reinforced neoprene or nylon-brush type weatherstripping and consisting of continuous metal retainers and UL listed.

#### [2.8.4 Locking Device

Provide [heavy-duty hasp and staple] [electric solenoid lock] on doors [\_\_\_\_], locate on [\_\_\_\_] side.

#### ]2.8.5 Pass Door

Provide a pass door of nominal size [\_\_\_\_] [as shown on the drawings] complete with an integral frame. Factory install and fit the pass door. The pass door must be complete with three full mortise spring hinges and a mortise latch set with flush cup and lever handle with US32D finish.

#### ]2.8.6 Top Guide Rollers

Provide top guide rollers of the [horizontal] [\_\_\_\_] type [with single wheel] [as indicated]. Provide rollers of [steel] [malleable iron] [cast iron] and sized for load conditions. Provide rollers that have [permanently lubricated] [\_\_\_\_] anti-friction bearings. Construct assemblies allowing removal. Construct top roller assemblies to transmit the load from the door to the building structure.

### 2.8.7 Bottom Rollers

Provide bottom rollers of [double-flanged cast steel] [welded pressed steel] [\_\_\_\_] having minimum tread diameter of [18] inch [\_\_\_\_]. When the door leaf height-to-width exceeds 3, provide adjustable rollers. Construct rollers for removal without removing the door leaf from rail.

- a. Provide treads with bearing seats. Horizontal clearance between the wheel and the rail must be [1/8] inch [\_\_\_\_] maximum at the bottom and [1/4] inch [\_\_\_\_] maximum at edge of flanges.
- b. Provide bearing seats meeting the bearing manufacturer's requirements. Have bearings of [ball] [roller] type arranged to ensure that vertical loads and horizontal wind loads will be transmitted from leaves to wheels. Bearings with seals must retain grease and prevent the entrance of dirt. Equip bearings with high-pressure grease fittings.

### 2.8.8 Track Cleaners

Provide door leaves with sweeps to clear debris from the rail head and wheel flange grooves as the leaf is moved.

#### 2.8.9 Toe Guards

Attach an adjustable full-length flexible toe guard reaching to the floor to the exterior bottom edge of each leaf of bi-parting doors.

#### 2.8.10 Warning Device

Provide alarms with each leaf which signals door movements and are [electronically] [electrically] [mechanically] activated.

#### 2.8.11 Track Bumpers

When limit switch fails, provide bumpers to limit door travel and automatically stop the door.

#### 2.8.12 Drive Clutch

When power is not applied, the clutch must disengage from the door drives.

#### 2.8.13 Manual Operators

Provide a manual [removable crank] [hand wheel] device that open doors. [Door leaf must have readily accessible brackets for crank storage.]

### 2.9 FINISH

#### 2.9.1 Steel Surfaces of Exterior Doors

Provide galvanized coating conforming to [ASTM A653/A653M](#) or [ASTM A924/A924M](#), coating designation G90, for steel sheets on all steel surfaces of exterior doors, after first applying a shop-primed finish. Prior to receiving primer, clean and phosphate-treat all surfaces for maximum paint adherence. Provide metallic oxide or synthetic resin primer of the manufacturer's standard type and apply by dipping or spraying. [For increased corrosion protection and coating system durability apply a coating system of [SSPC Paint 28](#) primer with a [SSPC Paint 36](#) topcoat by spray application.]

#### 2.9.2 Exposed Steel Surfaces of Interior Doors

Provide exposed steel surfaces of interior doors with a [shop-primed finish] [and] [galvanized coating]. Galvanizing must conform to [ASTM A653/A653M](#) or [ASTM A924/A924M](#), coating designation G90, for steel sheets. Provide primer which is a metallic oxide or synthetic resin primer of the manufacturer's standard type and applied by dipping or spraying. Prior to receiving primer, clean and phosphate treat all surfaces for maximum paint adherence. [For increased corrosion protection and coating system durability apply a coating system of [SSPC Paint 28](#) primer with a [SSPC Paint 36](#) topcoat by spray application.]

#### [2.10 SPECIAL FINISHES

Provide surfaces of [aluminum] [\_\_\_\_\_] doors with [an anodic] [\_\_\_\_\_] coating conforming to [[MIL-A-8625](#), Type II] [\_\_\_\_\_] ; seal coating. Determine weight and effectiveness of sealing and coating(s) in accordance with [[ASTM B137](#) and [ASTM B136](#)] [\_\_\_\_\_]. Apply [\_\_\_\_\_] coat(s) of [a clear

[methacrylate lacquer] [\_\_\_\_\_] to [\_\_\_\_\_] surfaces prior to shipment.

]2.11 SHOP PAINTING

- a. Paint [steel] [\_\_\_\_\_] portions of doors with [\_\_\_\_\_] coats of manufacturer's standard [rust-inhibitive] **Paint**.
- b. Paint [aluminum] [\_\_\_\_\_] surfaces which contact dissimilar metals with bituminous paint.
- c. Coat both dissimilar metal surfaces to prevent galvanic corrosion.
- d. Submit certificates of inspection from an independent testing laboratory, for oversize fire doors, stating that the doors and hardware are identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated.

]PART 3 EXECUTION

3.1 INSTALLATION

Install doors in accordance with **NFPA 80**, approved detail drawings and manufacturer's instructions. Accurately locate anchors and inserts for guides, brackets, [motors,] [switches,] hardware, and accessories. Upon completion, doors must be free from warp, twist, or distortion. Provide weather tight exterior doors. Lubricate and properly adjust doors, and demonstrate doors operate freely.

[3.2 FIELD FINISHING

Finish doors to receive field finish in accordance with Section **09 90 00 PAINTING, GENERAL**. Color must be [in accordance with Section **09 06 00 SCHEDULES FOR FINISHES**] [\_\_\_\_\_]. For field coatings applied to the exterior and interior of steel doors use coatings described in Paragraphs **STEEL SURFACES OF EXTERIOR DOORS** and **EXPOSED STEEL SURFACES OF INTERIOR DOORS**

]3.3 TESTING

Test doors in the presence of a representative of the door manufacturer and the Contracting Officer. Perform test consisting of [10] complete opening and closing cycles for each individual door, each pair of doors, and [three] complete manual cycles. On the fifth and tenth cycles, check, the inflatable seals for wear and leakage. Switches must function properly, and operation of doors must be smooth. Show an airtight condition when a successful soap-bubble test is made with the doors closed.

-- End of Section --

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## SECTION 08 14 00

## WOOD DOORS

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## ASTM INTERNATIONAL (ASTM)

**ASTM E90** (2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

**ASTM E283** (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

**ASTM E2226** (2015; R 2019b) Standard Practice for Application of Hose Stream

## CALIFORNIA AIR RESOURCES BOARD (CARB)

**CARB 93120** (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

## CSA GROUP (CSA)

**CSA Z809-08** (R2013) Sustainable Forest Management

## FOREST STEWARDSHIP COUNCIL (FSC)

**FSC STD 01 001** (2015) Principles and Criteria for Forest Stewardship

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

**ANSI/NEMA LD 3** (2005) Standard for High-Pressure Decorative Laminates

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 80** (2022) Standard for Fire Doors and Other Opening Protectives

NFPA 105 (2022) Standard for Smoke Door Assemblies and Other Opening Protectives

NFPA 252 (2022) Standard Methods of Fire Tests of Door Assemblies

PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013 (2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

SUSTAINABLE FOREST INITIATIVE (SFI)

SFI 2015-2019 (2015) Standards, Rules for Label Use, Procedures and Guidance

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770 Formaldehyde Standards for Composite Wood Products

UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint May 2020) Fire Tests of Door Assemblies

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A (2013) Interior Architectural Wood Flush Doors

ANSI/WDMA I.S.6A (2013) Interior Architectural Stile and Rail Doors

WOODWORK INSTITUTE (WI)

NAAWS 3.1 (2017; 2018 Errata Edition) North American Architectural Woodwork Standards

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Doors; G[, [\_\_\_\_\_]]

Submit drawings or catalog data showing each type of door unit [; include descriptive data of head and jamb weatherstripping with installation instructions]. Indicate within drawings and data the door types and construction, sizes, thickness, [methods of assembly,] [door louvers,] and [glazing,].



## SD-03 Product Data

Doors; G[, [\_\_\_\_\_]]

[ Recycled Content for Door Cores; S

] Accessories

Water-resistant Sealer

Sample Warranty

[ Sound Transmission Class Rating; G[, [\_\_\_\_\_]]

][ Fire Resistance Rating; G[, [\_\_\_\_\_]]

] SD-04 Samples

## Doors

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door Finish Colors; G[, [\_\_\_\_\_]]

Submit a minimum of three color selection samples [, minimum 3 by 5 inches in size representing wood stain] [for selection by the Contracting Officer].

## SD-06 Test Reports

Cycle-Slam

Hinge Loading Resistance

Submit cycle-slam test report for doors tested in accordance with [ANSI/WDMA I.S.1A](#), and hinge loading resistance test report for doors tested in accordance with [ANSI/WDMA I.S.6A](#).

## SD-07 Certificates

Certificates of Grade

[ Certified Sustainably Harvested Stile and Rail Wood Doors; S

][ Certified Sustainably Harvested Flush Wood Doors; S

][ Indoor Air Quality for Particleboard and Agrifiber Door Cores: S

] SD-11 Closeout Submittals

Warranty

## 1.3 CERTIFICATIONS

## 1.3.1 Certified Wood Grades

Provide [certificates of grade](#) from the grading agency on [x-ray resistant doors], [acoustical doors], and [fire doors].

#### [1.3.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by [FSC STD 01 001](#) [, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019](#), or other third party program certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

#### ] [1.3.3 Indoor Air Quality Certification

##### [1.3.3.1 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Provide products certified to meet requirements of both [40 CFR 770](#) and [CARB 93120](#). Provide current product certification documentation from certification body.

#### ] ] 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of [4 inch](#) thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. [ Do not store in a building under construction until concrete, masonry work, and plaster are dry.] Replace defective or damaged doors with new ones.

#### 1.5 [WARRANTY](#)

Warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

### PART 2 PRODUCTS

#### 2.1 [DOORS](#)

Provide doors of the types, sizes, and designs [indicated] [specified] free of urea-formaldehyde resins.

##### 2.1.1 Stile and Rail Doors

[Premium] [Standard] grade Ponderosa Pine doors or [premium or select] [standard] stile and rail doors conforming to [ANSI/WDMA I.S.6A](#). Furnish laminate panels in not less than three ply thickness. Provide flat panels with a minimum finished panel thickness of [1/2 inch](#) and [3/4 inch](#) thickness for raised panels. [ Provide [certified sustainably harvested stile and rail wood doors](#).]

##### 2.1.2 Flush Doors

Conform to [ANSI/WDMA I.S.1A](#) for flush doors. Provide hollow core doors

with lock blocks and 1 inch minimum thickness hinge stile. Hardwood stile edge bands of doors receives a natural finish, compatible with face veneer. Provide mill option for stile edge of doors scheduled to be painted. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware. [ Provide [certified sustainably harvested flush wood doors.](#)]

#### [2.1.2.1 Exterior Flush Doors

Solid wood core, Type I conforming to [ANSI/WDMA I.S.1A](#). Provide doors with [tempered hardboard] [medium density overlaid hardwood veneer] faces. Provide wood edge bands. Install in exterior flush doors with [aluminum] [bronze] [copper] flashings at the bottom of the openings.

#### ]2.1.2.2 Interior Flush Doors

Provide [staved lumber] [particleboard] [agrifiber] [hollow] core, Type II flush doors conforming to [ANSI/WDMA I.S.1A](#) with faces of [sound grade hardwood or hardboard for painted finish] [ [premium] [good] grade natural birch] [select [premium white] [red] birch] [[premium] [good] grade [red] [white] oak] [[premium] [good] grade walnut] [plastic laminate]. [Hardwood veneers must be [[rotary cut] [plain sliced] [quarter sliced]] [[random] [slip] [book] matched]]. [Finish plastic laminate faced doors on both vertical edges with [wood] [laminated plastic] of color matching faces.] [Door cores must have a minimum recycled content of 45 percent. Provide data identifying percentage of [recycled content for door cores.](#)] [Products must contain no added urea-formaldehyde resins. Provide certification of [indoor air quality for particleboard and agrifiber door cores.](#)]

#### 2.1.3 Bi-Fold Closet Doors

Provide [hardboard grade flush doors conforming to [ANSI/WDMA I.S.1A](#).] [paneled] [louvered] doors [premium or select] [standard] grade, conforming to [ANSI/WDMA I.S.6A](#) with [1-1/8] [1-3/8] inch thickness. Equip doors with the manufacturer's standard hardware, including tracks, hinges, guides, and pulls.

#### 2.1.4 Sliding Closet Doors

Provide flush wood doors to conform to [ANSI/WDMA I.S.1A](#). Provide [paneled] [and] [louvered] doors to conform to [ANSI/WDMA I.S.6A](#) [premium or select] [standard] grade with 1-3/8 inch thickness. Equip doors with the manufacturer's standard hardware.

#### 2.1.5 X-Ray Resistant Doors

[ANSI/WDMA I.S.1A](#) solid core flush doors, hardwood veneered, minimum [13/4] [2] [2 1/4] [2 1/2] inch thick, of sizes and construction indicated. Provide lead sheets with 99.9 percent pure lead, [\_\_\_\_\_] inch thickness, free from dross, oxide, inclusions, laminations, scale, blisters, and cracks. Locate lead sheets in accordance with manufacturer's standard, to extend fully from edge to edge, from top to bottom, and to be an integral part of the door. Provide wood edge strips compatible with face veneers.

#### 2.1.6 Acoustical Doors

[ANSI/WDMA I.S.1A](#), solid core, constructed to provide [Sound Transmission Class rating](#) of [35] [\_\_\_\_\_] when tested in accordance with [ASTM E90](#).

### 2.1.7 [Composite-Type] Fire Doors

Provide doors specified or indicated to have a fire resistance rating conforming to the requirements of UL 10B, ASTM E2226, or NFPA 252 for the class of door indicated. Affix a permanent metal label with raised or incised markings indicating testing agency's name and approved hourly fire rating to hinge edge of each door.

### 2.1.8 Prehung Doors

Frames for prehung interior doors to be for [painted] [clear] finish, with [3 piece adjustable jamb units] [3 piece adjustable jamb units with pins]. Provide doors complete with frame, hinges, and prepared to receive finish hardware.

## 2.2 ACCESSORIES

### 2.2.1 Door Louvers

Fabricate from wood and of sizes indicated. Provide louvers with a minimum of 35 percent free air. Equip louvers with [slat] [sightproof inverted vee slat] type. [Block hollow core doors to provide solid anchorage for the louvers.] Mount louvers in the door with [flush wood moldings.] [wood lip moldings.]

### 2.2.2 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings. [Provide moldings for doors to receive natural finish of the same wood species and color as the wood face veneers.] Provide moldings on the exterior doors with sloped surfaces. [Lip type moldings for flush doors.]

### 2.2.3 Weatherstripping

Provide weatherstripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Provide weatherstripping [tempered spring bronze] [or] [looped neoprene or vinyl held in an extruded non-ferrous metal housing]. Install [bronze weatherstripping with a minimum thickness of 0.0089 inch for sills, and a minimum thickness of 0.0063 inch elsewhere.] Air leakage of weatherstripped doors not to exceed [0.5] [1.25] cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

### 2.2.4 Additional Hardware Reinforcement

Provide the minimum lock blocks to secure the specified hardware. The measurement of top, bottom, and intermediate rail blocks are a minimum 125 mm 5 inch by full core width. Comply with the manufacturer's labeling requirements for reinforcement blocking, but not mineral material similar to the core.

## 2.3 FABRICATION

### 2.3.1 Marking

Stamp each door with a brand, stamp, or other identifying mark indicating quality and construction of the door.

### 2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based [, identify the standard under which preservative treatment was made,] and identify doors having a Type I glue bond.

### 2.3.3 Preservative Treatment

Treat doors scheduled for restrooms, janitor closets and other possible wet locations including exterior doors with a water-repellent preservative treatment and so marketed at the manufacturer's plant.

### 2.3.4 Adhesives and Bonds

**ANSI/WDMA I.S.1A.** Use Type I bond for exterior doors and Type II bond for interior doors. Provide a nonstaining adhesive on doors with a natural finish.

### 2.3.5 Prefitting

Provide factory [prefinished] [finished] [and] factory prefitted doors for the specified hardware, door frame and door-swing indicated. Machine and size doors at the factory by the door manufacturer in accordance with the standards under which the doors are produced and manufactured. The work includes sizing, beveling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules to coordinate the work.

### 2.3.6 Finishes

#### 2.3.6.1 Field Painting

Factory prime or seal doors, and field paint.

#### 2.3.6.2 Factory Finish

Provide doors finished at the factory by the door manufacturer as follows: [ **NAAWS 3.1** Section 1500, specification for System No. 4 Conversion varnish alkyd urea or System No. 5 Vinyl catalyzed.] [ WDMA System TR-8 (UV cured acrylated polyester/urethane) or TR-2 (catalyzed lacquer) or TR-4 (conversion varnish) factory finish systems that utilize water-based stains and finishes with ultraviolet UV protection.] The coating is **NAAWS 3.1** premium, medium rubbed sheen, [open] [closed] grain effect. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application.

#### 2.3.6.3 Plastic Laminate Finish

Factory applied, **ANSI/NEMA LD 3**, General or Specific purpose type, **0.050 inch** minimum thickness. Glue laminated plastic for hollow core doors to wood veneer, plywood, or hardboard backing to form door panel. Provide a combined thickness of laminate sheet and backing of **0.10 inch** minimum.

#### 2.3.6.4 Color

Provide [door finish colors](#) in accordance with Section [09 06 00 SCHEDULES FOR FINISHES](#).

#### 2.3.7 [Water-Resistant Sealer](#)

Provide manufacturer's standard water-resistant sealer compatible with the specified finish[es].

#### 2.4 SOURCE QUALITY CONTROL

Meet or exceed the following minimum performance criteria of stiles of "B" and "C" label fire doors utilizing standard mortise leaf hinges:

- a. [Cycle-slam](#): [Standard Duty Doors: 250,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of [ANSI/WDMA I.S.1A](#)] [Heavy Duty Doors: 500,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of [ANSI/WDMA I.S.1A](#)] [Extra Heavy Duty Doors: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of [ANSI/WDMA I.S.1A](#)].
- b. [Hinge loading resistance](#): Averages of ten test samples not less than [Standard Duty doors: [400 pounds](#) force] [Heavy Duty doors: [475 pounds](#) force] [Extra Heavy Duty doors: [550 pounds](#) force] when tested for direct screw withdrawal in accordance with [ANSI/WDMA I.S.6A](#) using a No. 12, [1-1/4 inch](#) long, steel, fully threaded wood screw. Drill [5/32 inch](#) pilot hole, use [1-1/2 inch](#) opening around screw for bearing surface, and engage screw full, except for last [1/8 inch](#). Do not use a steel plate to reinforce screw area.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a [1/16 inch](#) minimum, [1/8 inch](#) maximum clearance at sides and top, and a [3/16 inch](#) minimum, [1/4 inch](#) maximum clearance over thresholds. Provide [3/8 inch](#) minimum, [7/16 inch](#) maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of [1/8 inch in 2 inch](#). Door warp must not exceed [1/4 inch](#) when measured in accordance with [ANSI/WDMA I.S.1A](#).

##### 3.1.1 Fire[ and Smoke] Doors

Install fire doors in accordance with [NFPA 80](#). [Install smoke doors in accordance with [NFPA 105](#). ]Do not paint over labels.

##### 3.1.2 Prehung Doors

Install doors in accordance with the manufacturer's instructions and details. Provide fasteners for [stops] [and] [casing trim] within [3 inch](#) of each end and spaced [11 inch](#) on center maximum. Provide side and head jambs joined together with a dado or notch of [3/16 inch](#) minimum depth.

## [3.1.3 Weatherstripping

Install doors in strict accordance with the door manufacturer's printed installation instructions and details. Weatherstrip exterior swing-type doors at sills, heads and jambs to provide weathertight installation. Apply weatherstripping at sills to bottom rails of doors and hold in place with a brass or bronze plate. Apply weatherstripping to door frames at jambs and head. Shape weatherstripping at sills to suit the threshold. [Meeting stiles of exterior double-doors must be made weathertight by means of [a looped vinyl or neoprene strip in an extruded nonferrous metal housing applied to the edge of one door leaf] [a neoprene, vinyl or spring-bronze weatherstripped astragal secured to the inactive door leaf].]

] -- End of Section --

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## SECTION 08 22 20

## FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## ASTM INTERNATIONAL (ASTM)

ASTM D256 (2010; R 2018) Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

ASTM D635 (2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

ASTM D638 (2014) Standard Test Method for Tensile Properties of Plastics

ASTM D695 (2010) Standard Test Method for Compressive Properties of Rigid Plastics

ASTM D696 (2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer

ASTM D790 (2017) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D2344/D2344M (2016) Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure

## Differences Across the Specimen

ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E2074	(2000e1) Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies
ASTM E2112	(2019c) Standard Practice for Installation of Exterior Windows, Doors and Skylights
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115	(2016) Hardware Preparation in Steel Doors and Steel Frames
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## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code
NFPA 105	(2022) Standard for Smoke Door Assemblies and Other Opening Protectives
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction

## UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint May 2020) Fire Tests of Door Assemblies

UL Fire Resistance (2014) Fire Resistance Directory

## 1.2 ADMINISTRATIVE REQUIREMENTS

## 1.2.1 Pre-Installation Meeting

Within [30] [\_\_\_\_\_] days of Contract Award, the Contracting Officer will schedule a Pre-Installation meeting. For that meeting, submit the following Shop Drawings for review and approval:

a. Doors

b. Frames

[ c. Door Hardware Components and Accessories

] [d. Weather-stripping

] [e. Smoke Seals

] Include fabrication, installation details, schedule and location for doors, frames, hardware components and accessories, showing plans, elevations, sections, details, method of glazing within the door, construction and installation attachments to other work.

Submit manufacturer's catalog data, including material descriptions for doors, frames, and accessories, dimensions of individual components and profiles, and finishes for each type of door, frame, hardware components and accessories of size, design, and location indicated.

Submit documentation substantiating that the items provided within this section are from a manufacturer having a minimum of [5] [10] [\_\_\_\_\_] years experience in the design and manufacture of similar products and systems.

Submit a [Sample Warranty](#).

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Doors [; G[, [\_\_\_\_\_] ]]

Frames [; G[, [\_\_\_\_\_] ]]

[ Door Hardware Components and Accessories [; G[, [\_\_\_\_\_] ]]

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] [      Weather-stripping[; G[, [____]]]
] [      Smoke Seals[; G[, [____]]]
]
      SD-03 Product Data
      Doors[; G[, [____]]]
      Calculations[; G[, [____]]]
      Frames[; G[, [____]]]
[      Door Hardware Components and Accessories[; G[, [____]]]
] [      Weather-stripping[; G[, [____]]]
] [      Smoke Seals[; G[, [____]]]
] [      Thresholds[; G[, [____]]]
      Fire Resistance Rating for Doors and Frames[; G[, [____]]]
      SD-04 Samples
      Product Samples[; G[, [____]]]
      SD-07 Certificates
      Sample Warranty[; G[, [____]]]
      Warranty[; G[, [____]]]

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#### 1.4 QUALITY CONTROL

##### 1.4.1 Product Samples

Submit two sets of color chips representing specified colors and finishes.

Submit samples of each type, consisting of FRP door corner construction, minimum 6 inch by 6 inch legs.

Where color or texture variations are anticipated, such as anodized finishes, include two or more units in each set of samples indicating extreme limits of variations.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Delivery

Deliver FRP doors, frames, components and accessories in manufacturer's original unopened packaging. Mark and remove damaged materials from the project site. Where materials are covered by a referenced specification, label the package with the specification number, type, and class, as applicable. Deliver materials in sufficient quantity to allow work to proceed without interruption.

##### 1.5.2 Storage

Protect materials against moisture absorption and contamination or other

damage.

Store all materials on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer.

Do not store materials in buildings under construction until concrete, mortar, and plaster work is finished and dry.

Do not store materials outdoors unless approved by the Contracting Officer. Completely cover materials stored outdoors, with waterproof canvas protective covering. Tie covering securely to pallets to ensure complete weatherproofing is met. Provide sufficient ventilation to prevent condensation. Do not use polyethylene sheet as a covering.

Do not store materials in contact with other materials that might cause staining, denting, or other surface damage.

### 1.5.3 Handling

Prevent damage to corners, edges and ends of materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials.

## 1.6 PROJECT/SITE CONDITIONS

### 1.6.1 Existing Conditions

Take Field measurements prior to the preparation of drawings and fabrication.

## 1.7 WARRANTY

Submit sample material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard manufacturer warranty as required to comply with the specified requirements.

Furnish the manufacturer's [5] [10] [\_\_\_\_] year no dollar limit for materials and installation, workmanship, and deterioration of factory-applied finishes within specified warranty period. Provide warranty directly to the Government and commence warranty effective date at time of Government's acceptance of the work.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide door and frame components including, but not limited to, astragals, cores, faces, stiles, rails, heads, jambs, and internal reinforcement, which are FRP structural shapes manufactured by the pultrusion process. Ensure all structural shapes are composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements in accordance with [ASCE 7-16](#), [ [ICC IBC](#)] and dimensions specified.

Ensure fiberglass reinforcements are a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

Verify resins are of isophthalic polyester with chemical formulation necessary for corrosion resistance, strength and other physical properties as required.

2.1.1 Design Requirements

2.1.1.1 Finish Surfaces

Ensure all finished surfaces of FRP items and fabrications are smooth, resin-rich, free of voids and without dry spots, cracks, and un-reinforced areas. Completely cover all glass fibers with resin to protect against their exposure due to wear or weathering. All stiles, rails, heads, jambs, and internal reinforcement are to be integrally pigmented [yellow] [\_\_\_\_\_].

2.1.1.2 Ultraviolet Protection

Provide documentation that all pultruded structural shapes are further protected from ultraviolet (UV) attack with:

- a. Integral UV inhibitors within the resin
- b. Synthetic surfacing veil to help produce a resin rich surface
- c. UV resistant coating for outdoor exposures.

2.1.1.3 Flame Spread Rating

All FRP products to have a flame spread rating of 25 or less as per [ASTM E84 Tunnel Test](#).

2.1.1.4 Structural Properties

Meet minimum longitudinal structural properties with structural shapes in the door and frame system as follows:

Tensile Strength	<a href="#">ASTM D638</a>	30,000 psi
Compressive Strength	<a href="#">ASTM D695</a>	30,000 psi
Flexural Strength	<a href="#">ASTM D790</a>	30,000 psi
Flexural Modulus	<a href="#">ASTM D790</a>	1,600,000 psi
Short Beam Shear	<a href="#">ASTM D2344/D2344M</a>	4,500 psi
Impact, Notched	<a href="#">ASTM D256</a>	25 ft-lb/in
Thermal Expansion	<a href="#">ASTM D696</a>	.000008 in/in/F
Fire Resistance	<a href="#">ASTM E84</a>	Class I

2.1.1.5 [Fire Resistance Rating for Doors and Frames](#)

Provide complete [swing-type] [sliding-type] FRP [doors](#) with [frames](#) of the size, design and location indicated, including but not limited to, framing members, subframes, [transom,] [door light,] [adjoining side light,] [trim,] [molding,] [panel and plant,] and accessories.

[ Provide complete door hardware schedule, design and location as specified in specification Section [08 71 00 DOOR HARDWARE] [08 71 63 DETENTION HARDWARE] [08 71 63.10 ELECTRICAL LOCKING CONTROL FOR BRIGS].

] [Provide complete door [glazing] [louver] schedule, design and location as specified in specification Section [08 81 00 GLAZING] [08 88 53 DETENTION AND SECURITY GLAZING] [08 91 00 METAL [WALL] [AND] [DOOR] LOUVERS].

] a. FRP Door

Provide and install a seamless press-molded constructed FRP door. Laminate FRP face sheets to be applied while wet and uncured to an internal door stile and rail subframe/core assembly which is pressure molded under heat. Integrally fuse the composite door panel over the entire surface area, do not adhesive-bond at the perimeter stile and rail.

Provide door stiles and rails which are high-modulus pultruded FRP square or rectangular tube subframe. Miter and join tubes internally at the corners with solid polymer blocks to yield a one piece unit. Provide a mid-rail tube across the width of the door at lockset height and additional horizontal rails where specified. Chemically weld all connections. No mechanical fastening at the tube joints is permitted.

Provide a triangular shaped 3/8 inch phenolic resin impregnated kraft paper honeycomb cell core for maximum rigidity and compressive strength. Use of polyurethane foam or balsa wood cores are not permitted.

Provide internal reinforcement composed of high-modulus pultruded tubular FRP or high-density polymer compression blocks at all hardware and corner locations. No aluminum, steel, or wood blocking for reinforcement is permitted. A minimum pull-out force strength of 900 pounds per screw is required for all hinge locations.

Door faces are to utilize a chemical resistant thermosetting polyester resin with fiberglass reinforcing layers. Provide structural reinforcement which is knitted multi-layer material with layers of unidirectional fiberglass orientated in both vertical and horizontal directions for high stiffness, impact and warp resistance. Furnish door faces as indicated by the door elevation drawings.

Ensure the exposed finish of the FRP door faces are to be an ultra-violet light stabilized marine grade Neopentyl Glychol (NPG)-isophthalic polyester gelcoat integrally molded to a 25/30 mil wet thickness.

[ Provide an integral heavy pultruded FRP astragal on the stile edge of the inactive leaf for double doors of the same materials as specified for door stiles and rails.

] [Cutouts for door lights and louvers are to be manufactured and not field fabricated. Cutouts are to be totally enclosed by internal pultruded FRP stiles and rails as specified and incorporated into the door subframe with the opening completely fused to both door faces.

] [Provide raised panel door as indicated by the door elevation drawings and schedule. Plants to be applied by the manufacturer as an integral part of the door face and not field applied. All molding and plants are to be a rein material and installed by the manufacturer to resemble a raised panel door.

## ] b. FRP Frame

Provide FRP Door Frame utilizing a high-modulus pultruded structural FRP shape. Fabricate pultruded frame with a wall thickness of not less than 3/16 inch. Frames are to be one piece factory constructed with molded stop. Jamb and header to utilize miter corner connections chemically welded with FRP material ground for a visibly smooth frame face. Post and beam or mechanical fastened corners and joints are not acceptable. Provide sizes and shapes as detailed on the approved drawings.

Provide hardware reinforcement connections utilizing a chemical weld with FRP material at required locations. A minimum pull-out force strength of 1,100 lbs per screw is required for all hardware locations.

Frame finish is to be identical to door color and finish. [ Integrally mold a [15] [20] [25] wet mil resin rich gel coat into the frame during manufacturing.]

## [2.1.1.6 Fire-Rated Labeled FRP Door

Provide a Fire-Rated Door Assembly with a [20] [45] [60] [90] minute rating complying with NFPA 80 and UL Fire Resistance that are listed and labeled by [a qualified testing agency] [Underwriters Laboratories (UL)] [Factory Mutual Engineering and Research (FM)] [Warnock Hersey International (WHI)], for the fire-protection ratings indicated in the door and frame schedule. Base the door testing [at positive pressure] [as close to neutral pressure as possible] according to [ASTM E2074] [NFPA 252] [and] [UL 10B]. Provide certification for Oversized Fire-Rated Door Assembly units exceeding the size of tested assemblies, by a qualified testing agency, that the door complies with standard construction requirements for tested and labeled fire-rated door assemblies except for the size. Ensure door labels are permanently affixed at the factory to the hinge edge of the door and do not paint.

Provide and install a seamless press-molded constructed FRP door. Laminate FRP face sheets to be applied while wet and uncured to an internal door stile and rail subframe/core assembly which is pressure molded under heat. Integrally fuse the composite door panel over the entire surface area; do not adhesive-bond at the perimeter stile and rail.

Ensure door is provided with a fire resistant mineral core for maximum rigidity and compressive strength. Molding pressure and resin gel time are to be sufficient to allow for full penetration of resin into the cellular structure of the core to maximize shear and peel strengths at the door faces and core to reduce the possibility of delamination. Verify that the mineral core has been completely enclosed with an intumescent and FRP laminated edge perimeter, with the intumescent molded into the FRP door structure with a minimum 1/8 inch thick perimeter FRP edge banding prior to machining. Only Category A type door construction is permitted. Category B type construction with exposed edge intumescent components or products is prohibited.

Hardware reinforcement to be high-modulus pultruded tubular FRP or high-density polymer compressions blocks at all hardware and corner locations. No aluminum, steel, or wood blocking for reinforcement is permitted. A minimum pull-out force strength of 1,100 lbs per screw is required for all hinge locations.



Door faces are to utilize a chemical resistant thermosetting polyester resin formulated for the specified environment with a maximum flame spread of 25 in accordance with [ASTM E84](#), and self-extinguishing in accordance with [ASTM D635](#) with fiberglass reinforcing layers. Provide structural reinforcement of knitted multi-layer material with layers of unidirectional fiberglass orientated in both vertical and horizontal directions for high stiffness, impact and warp resistance. Furnish door faces as indicated by the door elevation drawings.

Ensure the exposed finish of the FRP door faces with an ultra-violet light stabilized marine grade Neopentyl Glychol (NPG)-isophthalic polyester gelcoat integrally molded to a 25/30 mil wet thickness.

- [ Provide an integral heavy pultruded FRP astragal on the stile edge of the inactive leaf for double doors of the same materials as specified for door stiles and rails.
- ] [Provide raised panel door as indicated by the door elevation drawings and schedule. Plants are to be applied by the manufacturer as an integral part of the door face and not field applied. All molding and plants are to be a rein material and installed by the manufacturer to resemble a raised panel door.
- ]] [2.1.1.7 Fire Rated Labeled FRP Frame

Provide a Fire-Rated Door Frame with a [20] [45] [60] [90] minute rating complying with [NFPA 80](#) that are listed and labeled by [a qualified testing agency] [Underwriters Laboratories (UL)] [Factory Mutual Engineering and Research (FM)] [Warnock Hersey International (WHI)], for the fire-protection ratings indicated in the door and frame schedule. Permanently affix frame labels, at the factory, to the hinge side of the door jamb. Do not paint.

Provide a Fire-Rated Door Frame utilizing a high-modulus pultruded structural FRP shape. Fabricate pultruded frame with a wall thickness of not less than [3/16 inch](#). Provide one piece factory constructed frames with molded stop. Utilize miter corner door jambs and header connections chemically welded with FRP material ground for a visibly smooth frame face. Post and beam or mechanical fastened corners and joints are not acceptable. Provide sizes and shapes to be as detailed on the approved drawings.

Provide a minimum density of [25 pounds per cubic foot](#) fire resistant composite formulated core for the specified environment with a maximum flame spread of 25 in accordance with [ASTM E84](#), and self-extinguishing as per [ASTM D635](#).

Frame finish is to be identical to door color and finish. Ensure a [15] [20] [25] wet mil resin rich gel coat is integrally molded into door frame during manufacturing.

#### ] 2.1.1.8 Frame Anchors

Provide anchorage devices and fasteners where necessary for fastening fabricated FRP door frame to the adjacent construction-in-place as recommended by the FRP frame manufacturer.

#### 2.1.1.9 Jamb Anchors

[ Provide anchors of the material, type, number, and spacing as required by the FRP frame manufacturer.

] [Provide Masonry Anchors of [corrosive-resistant] [hot-dip galvanized] steel [corrugated or perforated straps not less 2 inches wide by 10 inches long] [ 3/16 inch diameter] [adjustable loop] [T-shaped] minimum of 18 gauge thick.

] [Provide hot-dip galvanized steel Stud-Wall Type anchors designed to engage the [wood] [cold-formed steel] wall framing; not less than 18 gauge thick.

] [Provide Expansion Type Anchor for [concrete] [masonry] of [corrosive-resistant] [hot-dip galvanized] steel a minimum 3/8 inch diameter bolt with expansion shield or insert.

] [Provide a Powder-Actuated Anchorage System suitable for the application in [concrete] [steel] fabricated from [corrosive-resistant] [hot-dip galvanized] steel with clips or other accessory devices for attaching FRP frames.

#### ] 2.1.1.10 Hardware Preparation

Provide hardware reinforcing as specified. Prepare doors and frames for hardware in accordance with the applicable requirements of the FRP door and frame manufacturer. For additional requirements refer to ANSI/BHMA A156.115.

[ Provide [door hardware components and accessories] as indicated on the drawings[.], including [weather-stripping] [smoke seals] [thresholds] [\_\_\_\_].]

#### ] 2.1.2 Performance Requirements

##### 2.1.2.1 Structural

[Design exterior doors, frames and hardware to resist equivalent static design loads in accordance with ASTM F1642/F1642M, with frame deflections not to exceed L/160 of the unsupported member lengths. Use equivalent static design loads for connections of the door frame to the surrounding walls or hardware and associated connections, in accordance with ASTM F2248 and ASTM E1300. Design supporting elements and their connections based on their ultimate capacities. Provide calculations prepared by a Professional Engineer that substantiates compliance with these requirements, including insulation materials. Use frames that provide an equivalent level of performance. ] Provide framing members with shape and thickness sufficient to withstand [a design wind load of not less than [30] [\_\_\_\_] pounds per square foot of supported area] [the design wind load indicated] with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 0.050 inch nominal thickness.

[ Design doors and frames to withstand the specified design wind load acting normal to the plane of the entrance wall either inward or outward, in accordance with ASCE 7-16[ and ICC IBC].

##### ] 2.1.2.2 Air Infiltration

When tested in accordance with ASTM E283, air infiltration cannot to exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot 50 mile per hour wind.

### 2.1.2.3 Water Penetration

When tested in accordance with [ASTM E331](#), no water penetration is allowed, at a pressure of [8 pounds per square foot](#) of fixed area.

### 2.1.2.4 Provisions for Thermal Movement

Design doors and frames to provide for expansion and contraction of the component parts caused by an ambient temperature range of [0 to 100 degrees F](#) causing buckling, opening of joints, overstressing of fasteners, or other harmful effects.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Conform all work to the requirements of [29 CFR 1910](#), [29 CFR 1926](#), and [NFPA 241](#).

#### 3.1.1 FRP Frame

Set FRP door frame plumb and true, aligned, and secured with the adjacent construction-in-place, in conformance with [ASTM E2112](#). Anchor frame as specified and in accordance with the FRP door manufacturer's requirements.

##### Installation Tolerances

- a. Squareness: Plus or minus [1/16 inch](#), measure at the door rabbet on a line 90 degrees from the jamb perpendicular to the frame head.
- b. Alignment: Plus or minus [1/16 inch](#), measure at the jamb on a horizontal line parallel to the wall plane.
- c. Twist: Plus or minus [1/16 inch](#), measure at the opposite face corners of the jambs on parallel lines, and perpendicular to the wall plane.
- d. Plumb and True: Plus or minus [1/16 inch](#), measure at the jambs to the floor.

#### 3.1.2 FRP Door

Fit and hang door in accordance with clearances specified below:

##### Clearance Tolerances

- a. Jambs and Head: Plus [1/8 inch](#) or minus [1/16 inch](#).
- b. Pairs of Doors: Plus [1/8 inch](#) or minus [1/16 inch](#).
- c. Bottom of Door and Top of Threshold: Maximum [3/8 inch](#).
- d. Bottom of Door and Top of finish floor (No Threshold: Maximum [3/4 inch](#)).

#### [3.1.3 Labeled Door and Frame

Install fire-rated door and frame, including hardware, in accordance with [NFPA 101](#) [[NFPA 80](#)] [and] [[NFPA 105](#)].

## ]3.2 ADJUSTING AND CLEANING

Check and re-adjust all operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including all FRP that is warped, bowed, or otherwise unacceptable to the Contracting Officer.

## 3.3 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to final completion and acceptance of the project or replace with new, as directed by the Contracting Officer. Thoroughly clean all surfaces of the door and frame prior to final completion and acceptance of the project.

## 3.4 CLOSEOUT ACTIVITIES

3.4.1 [Warranty](#)

Submit the approved Warranty made out to the Government, to the Contracting Officer no later than [10] [\_\_\_\_\_] days prior to final inspection.

-- End of Section --

## SECTION 08 31 00

## ACCESS DOORS AND PANELS

05/17, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN WELDING SOCIETY (AWS)

**AWS D1.1/D1.1M** (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

**ASTM A36/A36M** (2019) Standard Specification for Carbon Structural Steel

**ASTM A653/A653M** (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

**ASTM A666** (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

**ASTM A1008/A1008M** (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

**ASTM E90** (2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

**ASTM E119** (2020) Standard Test Methods for Fire Tests of Building Construction and Materials

**ASTM E413** (2022) Classification for Rating Sound Insulation

**ASTM E1332** (2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation

## MASTER PAINTERS INSTITUTE (MPI)

**MPI 79** (2016) Primer, Alkyd, Anti-Corrosive for Metal

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies
NFPA 288	(2017) Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies

## UNDERWRITERS LABORATORIES (UL)

UL 10B	(2008; Reprint May 2020) Fire Tests of Door Assemblies
UL 263	(2011; Reprint Aug 2021) UL Standard for Safety Fire Tests of Building Construction and Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Access Doors And Panels; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Access Doors And Panels; G[, [\_\_\_\_\_]]

Hardware Including Locks and Keys; G[, [\_\_\_\_\_]]

Accessories; G[, [\_\_\_\_\_]]

[ Power Transfer Components; G[, [\_\_\_\_\_]]

] Recycled Content; S

## SD-04 Samples

Finishes; G[, [\_\_\_\_\_]]

[ SD-06 Test Reports

Fire-rating(s) of Assemblies; G[, [\_\_\_\_\_]]

Acoustical Ratings of Assemblies; G[, [\_\_\_\_\_]]

] 1.3 MISCELLANEOUS REQUIREMENTS

For [access doors and panels](#) provide the following:

#### 1.3.1 Shop Drawings

For field assembled access doors and panels, provide plans, elevations, sections, and details for each type of access door and panel assembly. Indicate frame, surface and edge construction, materials, and accessories. Indicate types of finished surfaces and details for panel edge conditions. Provide a door schedule with a unique number for each access door and panel, specific location in the project, location of hinges and hardware for each door. [ Indicate [[acoustical ratings of assemblies](#) as sound transmission class (STC) ratings] [,] [ and] [ [fire-rating\(s\) of assemblies](#)] [ and] [locations and [power transfer components](#) for electrified locks and alarms].]

#### 1.3.2 Product Data

For shop assembled access doors and panels, provide literature indicating sizes, types, frame and edge construction, finishes, [hardware](#), accessories such as gaskets, seals and weatherstripping, and location of each door and panel in the project. Indicate[ [acoustical ratings of assemblies](#),] [ [fire-ratings of assemblies](#),] [ and] [ locations and power transfer components for electrified locks and alarms.]. Provide details of adjoining work for each condition indicated.

#### 1.3.3 Finish Samples

Submit two color charts from manufacturer's standard color and finish options for each type of frame and panel assembly finish indicated.

#### [1.3.4 Test Reports

[Provide test reports for acoustical assemblies when tested in accordance with [ASTM E90](#) and classified in accordance with [ASTM E413](#) and [ASTM E1332](#).] [ Provide test reports for fire-rated assemblies when tested in accordance with [NFPA 252](#) or [UL 10B](#) for fire-rated access door assemblies installed vertically and [NFPA 288](#) for fire-rated access door assemblies installed horizontally.]

### ]1.4 PERFORMANCE REQUIREMENTS

#### 1.4.1 Structural Requirements

Provide floor access assemblies to support live loads indicated for floors. Deflection must not exceed 1/180 of span.

#### [1.4.2 Acoustical Requirements

Provide access panels with a minimum sound transmission class (STC) of [\_\_\_\_\_] [as indicated on the Drawings]. Provide gasketing in accordance with manufacturer's written recommendations.

#### ] [1.4.3 Fire-Rating Requirements

Provide access panels with a minimum fire-rating of [[\_\_\_\_\_] -Hour] [as indicated on the Drawings].

#### ] [1.4.4 Insulated Access Panels

Provide panels in a thickness as necessary to achieve a minimum R-value of [\_\_\_\_\_] [as indicated on the Drawings]. Provide gasketing as necessary for an airtight installation.

]1.4.5 Access Panels for Wet Areas

Provide panel assemblies that will be located in wet areas with corrosion resistant finishes and hardware and water resistant gasketing.

]1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

2.2 MATERIALS

2.2.1 Steel Plates, Shapes, and Bars

Provide in accordance with ASTM A36/A36M.

2.2.2 Sheet Steel

Provide cold rolled steel sheet substrate in accordance with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

2.2.3 Stainless Steel

Provide in accordance with ASTM A666, type 302 or 304.

2.2.4 Metallic Coated Steel Sheet

Provide in accordance with ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.2.5 Hardware

Provide automatic closing devices. Provide latch releases operable from insides of doors. [ Provide anchors in accordance with applicable fire test parameters.]

2.2.6 Hinges

Provide concealed spring hinges, 175 degrees of opening, with [non-]removable hinge pins [ to allow removal of door panel from frame]. Provide hinges of same steel as door and frame or in accordance with manufacturer's written recommendations. If providing non-continuous hinges, provide in numbers required to maintain alignment of door panel with frame. Provide coatings as necessary to permanently protect dissimilar metals from contact with one another; see Part 3 herein for more information.



### 2.2.7 Locks

Unless otherwise indicated, provide flush [screwdriver operated cam lock. Provide plastic sleeve or stainless steel bushings to protect holes in surface finishes for screwdriver to access lock.] [keyed lock] [tamper proof screws (spanner head locks) for access panels in locations requiring such security.] [ Lock cylinders are specified in Section 08 71 00 DOOR HARDWARE.]

### 2.2.8 Accessories

Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors in types as recommended by manufacturer's written installation instructions for each substrate indicated. Provide shims, bushings, clips, gaskets, and other devices as necessary for a complete installation.

## 2.3 FABRICATION

### 2.3.1 Thickness, Size, Edges

Fabricate frames for access doors of steel not lighter than 16 gage with welded joints and anchorage for securing to adjacent construction. Provide doors a minimum of 24 by 24 inches and of not lighter than 16 gage steel, with stiffened edges and welded attachments. Provide with eased (lightly rounded) edges, without burrs, snags or sharpness and exposed welds ground smooth.

### 2.3.2 Welding

Provide in accordance with AWS D1.1/D1.1M.

## 2.4 ACCESS ASSEMBLY TYPES

Unless indicated otherwise, provide flush-face steel access doors and panels with steel frames and flanges.

### [2.4.1 Recessed Doors

Provide recessed access doors[ with gypsum wallboard bead flanges]. Depth of door panel recess must accommodate the installed thickness of the finish material of the wall assembly for a flush finished condition of the wall and the access panel face. Reinforce panel and frame to prevent sagging.

### ] [2.4.2 Fire-rated Doors

#### 2.4.2.1 Door Construction

Provide ceiling access door construction in accordance with ASTM E119 or UL 263. Provide wall access doors in accordance with NFPA 252 or UL 10B.

#### 2.4.2.2 Labels

Provide class B opening according to UL 10B or test by another nationally recognized laboratory, approved by the Contracting Officer. Provide fire-rating as indicated herein, with a maximum temperature rise of 216 degrees F.

#### 2.4.2.3 Door Panel and Frame

[Steel][Stainless steel] sheet, with mineral fiber insulation core, insulated sandwich type construction.

] [2.4.3 Acoustical Doors

Manufacturer's standard assembly rated in accordance with STC requirements indicated herein. Acoustical insulating materials must have a flame spread rating of no more than 25.

] [2.4.4 Insulated Doors

Provide access door panels with [25 pounds per square inch density polystyrene][5 pound per cubic foot density, chlorofluorocarbon (CFC) free, foamed urethane] with a flame spread rating of no more than 25.

[Provide ceiling access panels for terminal air blenders as indicated. Provide pin-tumbler cylinder locks with appropriate cams in lieu of screwdriver-operated latches.]

] 2.5 FINISHES

[Provide steel frames and panel surfaces with a [baked enamel][powder coated finish. ]Provide manufacturer's standard two coat finish system consisting of one coat primer and one thermoset topcoat. Provide dry film thickness in 2 mils minimum.][ Provide steel frame and panel surfaces with a shop applied prime coat. [Field paint frames and panels to match wall and ceiling surfaces in which they occur.]] [ Provide stainless steel frames and panels.][ Provide brushed aluminum frames and panels.] Provide exposed fastenings that approximately match the color and finish of the each material to which fastenings are applied.

PART 3 EXECUTION

3.1 PREPARATION

Field verify all measurements prior to fabrication. Verify access door locations and sizes provide required maintenance access to installed building services components. Protect existing construction and completed work from damage during installation.

3.2 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, in accordance with manufacturer's written instructions. Include materials and parts as necessary for a complete installation of each item. Conceal fastenings where practicable. Poor matching of holes to fasteners is cause for rejection of the work.

3.3 ACCESS LOCATIONS

Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions.

3.4 ACCESS LOCATIONS IN WET AREAS

When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies as indicated in Part I herein.

[3.5 RECESSED ACCESS DOORS

Install fire-rated access doors in fire-rated partitions and ceilings in accordance with [NFPA 80](#).

]3.6 FIELD PAINTING

Field painting primed access doors in accordance with the requirements of Section [09 90 00 PAINTS AND COATINGS](#).

3.7 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with [MPI 79](#) to prevent galvanic or corrosive action.

3.8 ADJUSTMENT

Adjust hardware so that door panel opens freely. Adjust door when closed center door panel in frame.

3.9 ENVIRONMENTAL CONDITIONS

Do not paint surfaces when damp or exposed to weather, when surface temperature is below [45 degrees F](#) or over [95 degrees F](#), unless approved by the Contracting Officer.

-- End of Section --

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## SECTION 08 32 13

## ALUMINUM SLIDING GLASS DOORS

08/20, CHG 1: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants

AAMA 1503 (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA/WDMA/CSA 101/I.S.2/A440 (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## ASTM INTERNATIONAL (ASTM)

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

ASTM D3656/D3656M (2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

ASTM E2016 (2022) Standard Specification for Industrial Woven Wire Cloth

ASTM F842 (2017) Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a

code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aluminum Sliding Glass Doors

SD-03 Product Data

Aluminum Sliding Glass Doors

Hardware

Glazing

Weatherstripping

Screens

Finish

SD-04 Samples

Finish

SD-10 Operation and Maintenance Data

Aluminum Sliding Glass Doors, Data Package 1; ; G[, [\_\_\_\_\_]]

1.2.1 Shop Drawing Information

Submit drawings for aluminum sliding glass doors[, screens,] and accessories that indicate elevations of each door type, full size sections, thickness, nominal gages of metal, fastenings, proposed method of installation and anchoring, the size and spacing and method of glazing, details of operating hardware, method and material for weatherstripping, type of finish, and screen details.

1.2.2 Samples Information

Submit color chart of factory color coatings when factory-finished color coating is to be provided.

1.3 TEMPORARY PROTECTIVE COVERING

Prior to shipment from the factory, finished surfaces of aluminum sliding glass doors must receive a protective covering of waterproof tape, strippable plastic, or cardboard to protect against discoloration and surface damage that may occur during transportation, storage, and construction activities. Also, do not apply coatings or lacquers to surfaces to which caulking and glazing compounds must adhere. Covering must be readily removable after installation.

1.4 DELIVERY AND STORAGE

Inspect aluminum sliding glass doors, [ including screens, ] hardware and accessories, for damage and unload and store doors upright on platforms in accessible spaces with a minimum of handling. The storage spaces must be

dry, adequately ventilated, free from heavy dust and not subject to combustion products, sources of water or other conditions that could damage the door. Storage spaces must have easy access for inspection and handling of doors.

#### [1.5 EXTRA STOCK

Deliver an extra stock of markings for glass panels to the Government for use in future replacement of original markings. The extra stock shall be of the same designs, colors, and materials as the markings installed on this project. Furnish markings in original containers or packages in a quantity not less than [\_\_\_\_\_] percent of the amount of markings to be installed.

### ]PART 2 PRODUCTS

#### 2.1 ALUMINUM SLIDING GLASS DOORS

Provide aluminum sliding glass doors with sliding panels and fixed panels in the sizes and arrangements indicated and conforming to [AAMA/WDMA/CSA 101/I.S.2/A440](#) for Type [SGD-R15] [SGD-C20] [SGD-HC40], [SGD-\_\_\_\_\_] except frame must be equipped with thermal barrier. [ Mark panels identically and permanently to visibly interrupt the span of glass. Use markings [of the design and color indicated] [approximately 4 square inches] of opaque, pressure-sensitive vinyl film with precoated adhesive.] Sliding door glazing must be set in aluminum frames and roller assemblies of sufficient strength to withstand lateral live stresses and static load or weight requirements.

##### 2.1.1 Hardware

Sliding door panel must have a manually operated adjustable latch [operable by latch handle or slide bar from inside only] [operable by a five-pin tumbler cylinder lock on outside and thumb-turn on the inside] [operable by a five-pin tumbler cylinder lock from either side]. Fit sliding screen door panel with a self-latching hook or rotary-type latch operable from [inside only] [both sides]. [ Provide pulls for both inside and outside of sliding panel and the sliding screen panel]. [ Provide a pull on the inside of the sliding door panel and the sliding screen panel only]. [ Provide auxiliary pin lock [bottom] [top and bottom] on inner side of sliding glass door panel opposite manually operated adjustable latch.] Exposed hardware is to be aluminum or stainless steel, color finished to match door color finish.

##### 2.1.2 Glazing

Factory glazed sliding glass doors, including fixed panel, with double-glazed glass conforming to [ASTM C1048](#), Kind FT, Condition A, Type [I] [II], Class 1, not less than [1/4] [\_\_\_\_\_] inch thick. [ Double glazing must have a minimum condensation resistance factor of [\_\_\_\_\_] in accordance with [AAMA 1503](#).] Glazing material must be certified as meeting [CPSC 16 CFR 1201](#), Category II. Set glazing unit in polyvinyl-chloride or synthetic rubber glazing channels. Channels must be reusable when replacing glass and have mitered or continuous corners. Channels exposed to view must blend in color with the aluminum frame finish.

##### 2.1.3 Weatherstripping

Provide four sides of each sliding panel and interlocking stiles and jambs

with weatherstripping. Weatherstripping must conform to [AAMA/WDMA/CSA 101/I.S.2/A440](#) and must provide maximum protection against the elements and be designed for ease of replacement.

#### 2.1.4 Screens

Provide horizontal sliding aluminum screens in combination with aluminum sliding glass doors. Provide screen frames consisting of aluminum shapes of size and design standard with the door manufacturer. Frames must have removable splines of aluminum or vinyl and must permit screening fabric replacement. Screening shall be [18 by 16 mesh aluminum conforming to [ASTM E2016](#),] [plastic-coated fibrous glass conforming to [ASTM D3656/D3656M](#), Class 2, 18 by 14 mesh, [\_\_\_\_ color] [selected color to match doors]]. Install screening with weave parallel with frames and sufficiently tight to present a smooth appearance. Conceal edges of screening in the spline channel. Screens must be complete with rollers, hardware, and accessories and must slide on or within tracks provided in the door frame members. Design and assemble doors so that aluminum-to-aluminum contact of moving members will not occur. Provide insect-proofing, formed of wool pile or other suitable material, at interlocking stiles and jambs. Finish on screen frames must be as specified for doors.

#### 2.1.5 Finish

Before fabrication, clean sliding glass door units and give a [AA-M-10-C22-A31 clear (natural) anodized finish] [AA-M-10-C22-A41 clear (natural) anodized finish] [AA-M-10-C22-A32 [\_\_\_\_] (color) anodized finish] [AA-M-10-C22-A42 [\_\_\_\_] (color) anodized finish] in accordance with the requirements of the [AA DAF45](#). The finish thickness must be [A41, 0.4 mil or greater] [A42, 0.7 mil or greater].

#### 2.2 CAULKING AND SEALING

As specified under Section [07 92 00 JOINT SEALANTS](#).

#### 2.3 FORCED ENTRY RESISTANT DOORS

In addition to meeting [AAMA/WDMA/CSA 101/I.S.2/A440](#), doors designated forced entry resistant must conform to [ASTM F842](#).

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Doors, Frames, and Accessories

Install doors, frames, framing members, hardware, and accessories in accordance with approved shop drawings and the requirements specified herein. Set frames securely anchored in place to straight, plumb, square, level condition without distortion and in alignment. Install door panels to retain proper weathering contact with frames. Caulk metal-to-metal joints between frame members and remove excess material. Caulking around perimeter of door frame and wall openings to provide weathertight installation must be accomplished in accordance with [AAMA 800](#) and manufacturer's recommendations. Finished work must be rigid, neat in appearance, and free from defects. Upon completion, adjust sliding doors to operate properly. Thoroughly clean aluminum frames and glass in accordance with manufacturer's recommendation. Doors damaged prior to completion and acceptance must be restored to original manufactured



condition or replaced with new doors as directed.

### 3.1.2 Protection of Aluminum from Dissimilar Materials

#### 3.1.2.1 Aluminum to Dissimilar Metals

Prevent aluminum surfaces from contacting dissimilar metals other than stainless steel, zinc, or white bronze by one or a combination of the following:

- a. Paint dissimilar metal with one coat of heavy-bodied bituminous paint.
- b. Apply caulking between aluminum and dissimilar metal.
- c. Paint dissimilar metal with primer, followed by one coat of aluminum paint or other suitable lead-free coating.
- d. Use nonabsorptive tape or gasket in permanently dry locations.

#### 3.1.2.2 Drainage from Dissimilar Metals

Paint dissimilar metals located in areas where their drainage washes over aluminum to prevent the staining of aluminum.

#### 3.1.2.3 Aluminum to Masonry and Concrete

Prevent aluminum surfaces from coming into contact with mortar, concrete, or other masonry materials by applying one coat of heavy-bodied bituminous paint to the aluminum surfaces.

#### 3.1.2.4 Aluminum to Wood

Prevent aluminum surfaces from coming into contact with wood, treated wood, or similarly absorptive materials by one or a combination of the following methods:

- a. Paint aluminum surfaces with two coats of aluminum paint or one coat of heavy-bodied bituminous paint.
- b. Paint the wood, treated wood, or other absorptive surfaces with two coats of aluminum paint and seal contiguous joints with caulking compound.

-- End of Section --

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## SECTION 08 33 13

## COILING COUNTER DOORS

05/09, CHG 2: 11/12

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2020a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_]]

## SD-03 Product Data

Warranty  
Rolling Counter Doors  
Installation  
Cleaning

## SD-06 Test Reports

### Drop-test

SD-10 Operation and Maintenance Data

SD-11 Closeout Submittals

Rolling Counter Door (Non-Rated)  
Fire-Rated Rolling Counter Door

## 1.3 QUALITY ASSURANCE

Submit **Detail Drawings** showing elevations of each door type, details of anchorage, details of construction, location and description of hardware, shape and thickness of materials, details of joints and connections, and details of guides and fittings. Include a schedule showing the location of each counter door with the drawings.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver rolling counter doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store rolling counter doors in accordance with the manufacturer's instructions in a dry location that is adequately ventilated and free from dust, water, or other contaminants, and in a manner that permits easy access for inspecting and handling. Handle doors carefully to prevent damage. Replace damaged items that cannot be restored to like-new condition.

## 1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period. Submit no later than 30 days prior to final inspection.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Furnish **rolling counter doors** of the type, size, and design indicated on the drawings. Provide the standard product of a manufacturer regularly engaged in the production of rolling counter doors. Provide each door with a permanent label showing the manufacturer's name and address and the model number of the door. Submit Manufacturer's descriptive data and catalog cuts.

### 2.2 BASIC COMPONENTS

#### 2.2.1 Curtain

Fabricate the curtain of [extruded aluminum slats conforming to **ASTM B221**, Alloy 6063] [ **22 gauge** stainless steel slats conforming to **ASTM A240/A240M**, Type 304 or Type 430] [or] [ **22 gauge** galvanized steel slats conforming to **ASTM A653/A653M**, Coating Designation [G60] [G90]]. Provide thickness of slat material as required by width of opening [or as required by specified fire-rating.] Use slats approximately **1-1/4 to 1-1/2 inch** wide with a depth of crown of **1/2 inch**. Fit alternate slats with endlocks to maintain curtain alignment. Provide bottom of curtain with angle or tubular bar reinforcement matching the curtain, and fitted with a resilient bottom seal.

### 2.2.2 Jamb Guides

Furnish guides of [ 1/8 inch minimum thickness extruded aluminum conforming to ASTM B221, Alloy 6063, and fitted with neoprene silencers or replaceable heavy nap striping to eliminate noise and dust infiltration.] [ 13 gauge minimum thickness stainless steel conforming to ASTM A240/A240M, Type 304 or Type 430.] [ 13 gauge minimum thickness galvanized steel angles conforming to ASTM A653/A653M, Coating Designation minimum G40.]

### 2.2.3 Counterbalance Shaft Assembly

Furnish the curtain coiled around a steel tube of sufficient thickness and diameter to prevent deflection exceeding 0.03 inch per foot. Provide a barrel containing oil tempered helical steel torsion springs capable of sufficient torque to counterbalance the weight of the curtain. Calculate the springs to provide a minimum of [7,500] [\_\_\_\_\_] operating cycles (one complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position).

### 2.2.4 Brackets

Furnish brackets of a minimum 12 gauge thickness steel if flat plate, or 16 gauge thickness if there are a minimum of 3 returns of 3/4 inch width.

### 2.2.5 Hood

Provide a hood of [ 0.040 inch minimum thickness aluminum sheet conforming to ASTM B209, Alloy 5005.] [ 24 gauge stainless steel conforming to ASTM A240/A240M, Type 304 or Type 430.] [ 24 gauge galvanized steel conforming to ASTM A653/A653M, Coating Designation minimum G40.]

### 2.2.6 Locks

Lock the curtain at [each side of the bottom bar by an integral slide bolt] [both sides of bottom bar by a chrome-plated cylinder lock keyed into the building keying system]. Locate lock on the [\_\_\_\_\_] room side of the counter door. [Provide keying [conforming to Section 08 71 00 DOOR HARDWARE] [as indicated].]

## 2.3 ROLLING COUNTER DOOR (NON-RATED)

Construct rolling counter doors, curtains, guides and hood components of [aluminum] [stainless steel] [galvanized steel] conforming to the requirements specified herein. Submit [Six] [\_\_\_\_\_] complete copies of Data Package 2 for Rolling Counter Doors (Non-Rated) and Fire-Rated Rolling Counter Doors (next paragraph) in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide a list of the parts recommended by the manufacturer to be replaced after [1 year] [and] [3 years] of service.

## 2.4 FIRE-RATED ROLLING COUNTER DOOR

Furnish fire-rated rolling counter doors, [[Class A (3 hr.)] [Class B (1-1/2 hr.)] [Class C (3/4 hr.)] [Class D (1-1/2 hr.)] rated] [as shown] and conforming to the requirements specified and to NFPA 80 for the class indicated. Provide labels of a recognized testing agency for the doors, indicating the applicable fire resistance rating. The construction details necessary for labeled rolling counter doors will take precedence over details indicated or specified herein. Furnish door curtains, guides and hood of [stainless steel] [galvanized steel]. Provide fire-rated rolling

counter doors complete with hardware, accessories, and automatic closing device. Provide rolling counter doors, in exit corridor walls, with perimeter smoke and draft control gasketing.

## 2.5 INTEGRAL FRAME ROLLING COUNTER DOOR (RATED OR NON-RATED)

Furnish integral frame rolling counter door of [[aluminum] [stainless steel] [galvanized steel].] [[[Class A (3 hr.)] [Class B (1-1/2 hr.)] [Class C (3/4 hr.)] [Class D (1-1/2 hr.)]]] [as shown], [stainless steel] [galvanized steel]. Conform fire-rated doors to the requirements of **NFPA 80** for the Class indicated and bearing the labels of a recognized testing agency indicating the applicable fire resistance rating. Form jambs to create guides for the curtain. Provide head and jambs of 16 gauge thickness. Provide counter of 14 gauge thickness. Provide rolling counter doors, in exit corridor walls, with perimeter smoke and draft control gasketing.

## 2.6 AUTOMATIC CLOSING DEVICE

Equip fire-rated counter doors with an automatic closing device which operates upon [the fusing of a 165 degree F fusible link] [activation of the building's [fire alarm system] [smoke alarm system] [heat detector system]]. Furnish fire and smoke doors that easily reset by the facility user after they have been released by the detection system. Resetting the door must not require the use of special tools.]

## 2.7 FINISH

Exposed parts of the counter door, including the curtain, bottom rail, guides, and hood must be of uniform finish and appearance. Furnish [aluminum with a clear anodized finish.] [stainless steel with a No. 4 finish.] [steel galvanized coating with a [prime coat] [and] [a baked-on or powder-coated Factory top coat finish].] Give all other steel parts a shop coat of primer paint standard with the manufacturer. Provide a factory coated color [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_].

# PART 3 EXECUTION

## 3.1 INSTALLATION

Install doors in accordance with approved detail drawings and manufacturer's instructions. Accurately locate anchors and inserts for guides, brackets, hardware, and other accessories. Upon completion, warped, twisted, or distorted doors are not acceptable. Lubricate, properly adjust, and demonstrate doors to operate freely. Conform fire-door installation with **NFPA 80** for the class indicated and the manufacturer's instructions.

## 3.2 OPERATION

### 3.2.1 Manual Operation

Provide curtain operated by means of [manual push-up with lift handles or continuous full width lift bar] [manual crank with removable handle].

### 3.2.2 Power Operation

Furnish a high-starting torque, reversible type motor of sufficient power

and torque output to move the door in either direction from any position at the required speed. Provide power operator with an emergency push-up operation, limit switch, three-button type control marked "OPEN", "CLOSE", and "STOP". Provide control voltage of [24 vac] [120 vac]. Provide conduit and wiring necessary for proper operation in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

### 3.3 TESTS

Drop-test the fire doors in accordance with NFPA 80 to show proper operation and full automatic closure and reset in accordance with the manufacturer's instructions. Provide a written record of initial test to the Contracting Officer.

### 3.4 FIELD FINISHING

Factory prime doors to receive field finishing as required, and then finish in accordance with Section 09 90 00 PAINTS AND COATINGS. Provide color [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_].

### 3.5 CLEANING

Clean aluminum and stainless steel doors in accordance with manufacturer's approved instructions. Submit Manufacturer's preprinted installation and cleaning instructions.

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## SECTION 08 33 23

## OVERHEAD COILING DOORS

08/20, CHG 1: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP (2021) Fundamentals Handbook, I-P Edition

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B29.400 (2001; (R 2008) (R 2013) (R 2018)) Combination, "H" Type Mill Chains, and Sprockets

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A48/A48M (2003; R 2021) Standard Specification for Gray Iron Castings

ASTM A53/A53M (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307 (2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM F568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

## DOOR AND ACCESS SYSTEM MANUFACTURERS ASSOCIATION (DASMA)

ANSI/DASMA 108	(2017) Standard Method for Testing Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference
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## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2016) Motors and Generators - Revision

1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

**NEMA ST 1** (1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 70** (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

**NFPA 80** (2022) Standard for Fire Doors and Other Opening Protectives

UNDERWRITERS LABORATORIES (UL)

**UL 325** (2017; Reprint Feb 2020) UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems

**UL 674** (2011; Reprint Dec 2020) UL Standard for Safety Electric Motors and Generators for Use in Hazardous (Classified) Locations

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Overhead Coiling Doors [; G[, [\_\_\_\_]]]

Counterbalancing Mechanism [; G[, [\_\_\_\_]]]

Manual Door Operators [; G[, [\_\_\_\_]]]

Electric Door Operators [; G[, [\_\_\_\_]]]

Bottom Bars [; G[, [\_\_\_\_]]]

Guides [; G[, [\_\_\_\_]]]

Mounting Brackets [; G[, [\_\_\_\_]]]

Hood [; G[, [\_\_\_\_]]]

Installation Drawings [; G[, [\_\_\_\_]]]

### SD-03 Product Data

Overhead Coiling Doors[; G[, [\_\_\_\_]]]

Hardware[; G[, [\_\_\_\_]]]

Counterbalancing Mechanism[; G[, [\_\_\_\_]]]

Manual Door Operators[; G[, [\_\_\_\_]]]

Electric Door Operators[; G[, [\_\_\_\_]]]

Fire-Rated Door Assembly[; G[, [\_\_\_\_]]]

Recycled content for steel curtain slats; S

Recycled content for stainless steel curtain slats; S

#### SD-05 Design Data

Overhead Coiling Doors[; G[, [\_\_\_\_]]]

Hardware[; G[, [\_\_\_\_]]]

Counterbalancing Mechanism[; G[, [\_\_\_\_]]]

Manual Door Operators[; G[, [\_\_\_\_]]]

Electric Door Operators[; G[, [\_\_\_\_]]]

Fire-Rated Door[; G[, [\_\_\_\_]]]

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals, Data Package 2[; G[, [\_\_\_\_]]]

#### SD-11 Closeout Submittals

Warranty[; G[, [\_\_\_\_]]]

### 1.3 QUALITY CONTROL

Provide fire-rated door assemblies bearing the Underwriters Laboratories, Warnock Hersey, Factory Mutual or other nationally recognized testing laboratory label for [Class [\_\_\_\_] rating.] [the rating listed on the drawings.] Provide a permanent label for each door showing the manufacturer's name and address, and the model/serial number of the door.

Provide oversized fire-rated door assemblies with a listing agency oversize label, or a certificate signed by an official of the manufacturing company certifying that the door and operator are designed to meet the specified requirements.

#### 1.3.1 Warranty

Furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship for not less than [two] [\_\_\_\_] years after completion and acceptance of the project.

Warrant that upon notification by the Government, any defects in material,

workmanship, and door operation are immediately correct within the same time period covered by the guarantee, at no cost to the Government.

### 1.3.2 Operation And Maintenance Submittals

Submit [6] [\_\_\_\_\_] copies of the [operation and maintenance manuals](#) 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to cContract completion.

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

- [ Manual Door Operators
- ] Electric Door Operators
- [ Hood
- ] Counterbalancing Mechanism
- Painting

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, operating procedures, and safety precautions.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in an adequately ventilated dry location that is free from dirt and dust, water, or other contaminants. Store in a manner that permits easy access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide overhead coiling doors with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated. Doors must be spring counterbalanced, rolling type, and designed for use on [exterior] [or] [interior] openings, as indicated. Doors must be operated [by means of lifting handles] [by hand chain with gear or sprocket reduction] [by hand crank with gear or sprocket reduction] [by electric-power with auxiliary hand chain operation]. Doors to be surface-mounted type with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position. [Mount exterior doors [as indicated] [on interior face of walls].] [Where doors are indicated to be chain- or crank-operated, the door design and construction must allow for future installation of electric-power operation.]

#### 2.1.1 Design Requirements

##### 2.1.1.1 Door Detail Shop Drawings

Provide [installation drawings](#) for door assemblies which show: elevations

of each door type, shape and thickness of materials, finishes, details of joints and connections, details of guides and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links on wiring diagrams for power, signal and controls. [ For motor-operated doors include supporting brackets for motors, location, type, and ratings of motors, and safety devices.] Include a schedule showing the location of each door with the drawings.

## 2.1.2 Performance Requirements

### 2.1.2.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least [\_\_\_\_\_] pounds per square foot in accordance with ANSI/DASMA 108. Provide test data showing compliance with ASTM E330/E330M. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested. Ensure that the complete assembly meets or exceeds the requirements of ASCE 7-16.

### 2.1.2.2 Fire-Rated Doors, Frames, and Hardware

Provide fire-rated doors, frames, and hardware that are tested, rated, and labeled in accordance with Underwriters Laboratories, Factory Mutual or Warnock Hersey. Fire doors must be complete with hardware, accessories, and automatic closing device as required by NFPA 80. Indicate on the labels the rating in hours, per NFPA 80, of fire exposure duration. Additionally, ensure a letter follows the hourly rating to designate the location for which the assembly is designed and the temperature rise on the unexposed door face at the end of 30 minutes of fire exposure is required. The construction details necessary for labeled doors take precedence over details indicated or specified for non-labeled doors.

Provide and attach metal UL labels to the bottom bar.

### 2.1.2.3 Oversized Coiling Fire-rated Door Assemblies

Where fire-rated doors and frames exceed the size for which testing and labeling services are offered, furnish certificates of inspection from either UL, Factory Mutual or Warnock Hersey. State within certificates that except for size; doors, frames, and hardware are identical in design, materials, and construction to a door that has been tested and rated.

### 2.1.2.4 Operational Cycle Life

Design all portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue to operate through a minimum number of [10] [\_\_\_\_\_] cycles per [day] [hour]. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

## 2.2 COMPONENTS

### 2.2.1 Overhead Coiling Doors

#### 2.2.1.1 Curtain Materials and Construction

[ Provide curtain slats fabricated from Grade A steel sheets conforming to

ASTM A653/A653M, with the additional requirement of a minimum yield point of 33,000 psi. Provide [22] [20] [18] gauge sheets, Grade 40 steel with galvanized steel zinc coating in conformance with ASTM A653/A653M and ASTM A924/A924M. Provide steel curtain slats containing a minimum of [20] [\_\_\_\_\_] percent recycled content. Submit data identifying percentage of recycled content for steel curtain slats.

] [Provide curtain slats fabricated from Type 304 stainless steel sheets conforming to ASTM A666; sheet thickness as required by the size of the door to meet the required windload. Provide stainless steel curtain slats containing a minimum of [60] [\_\_\_\_\_] percent recycled content. Submit data identifying percentage of recycled content for stainless steel curtain slats.

] [Provide curtain slats fabricated from aluminum sheets conforming to ASTM B209, or ASTM B221 extrusions, alloy and tempering standard from the manufacturer for type of use and finish indicated; with a thickness as required by the size of the door to meet the required windload.

] Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Ensure the provided slats are continuous without splices for the width of the door.

Provide slats filled with manufacturer's standard thermal insulation, complying with the maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose the insulation completely within the slat faces on the interior surface of the slats.

#### 2.2.1.2 Non-Insulated Curtains

Form curtains from the manufacturer's standard shapes of interlocking slats.

#### 2.2.1.3 Insulated Curtains

Form curtains from manufacturer's standard shapes of interlocking slats. Supply a slat system with a minimum R-value of [4] [\_\_\_\_\_] when calculated in accordance with ASHRAE FUN IP. Slats to consist of a [urethane] [polystyrene] core not less than 11/16 inch thick, completely enclosed within metal facings. Slat steel thickness as required by the size of the door to meet specified performance requirements. The insulated slat assembly requires a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E84.

#### 2.2.1.4 Curtain Bottom Bar

Install curtain bottom bars as pairs of angles or using extrusions from the manufacturer's standard steel, stainless and aluminum extrusions not less than 2.0 by 2.0 inches by 0.188 inch. Do not use aluminum on doors more than 16 feet wide. Ensure steel extrusions conform to ASTM A36/A36M. Stainless steel extrusions conforming to ASTM A666, Type 304. Aluminum extrusions conforming to ASTM B221. Galvanize angles and fasteners in accordance with ASTM A653/A653M and ASTM A924/A924M. Coat welds and abrasions with paint conforming to ASTM A780/A780M.

[ Provide two minimum 2 inch by 2 inch by 1/8 inch structural steel angles.

#### ] [2.2.1.5 Vision Lites

Provide complete manufacturer's standard vision panels assembly consisting

of clear acrylic glazing panels or fire-rated glass as required for the type door.

#### ]2.2.1.6 Endlocks (and Windlocks)

Provide endlocks of Grade B cast steel conforming to [ASTM A47/A47M](#), galvanized in accordance with [ASTM A153/A153M](#). Secure locks at every other curtain slat. [In addition to endlocks, exterior doors which are more than [16 feet](#) wide or which have a design wind load of more than [20 pounds per square foot](#), must have windlocks of manufacturer's standard design. Windlocks must prevent curtain from leaving guide because of deflection from wind pressure or other forces.]

#### 2.2.1.7 Weather Stripping

Provide a hood baffle inside the hood that is a minimum [1/16 inch](#) thick sheet of vinyl, neoprene rubber or equivalent. Provide guide weather stripping that is a minimum [1/16 inch](#) thick sheet of vinyl, neoprene rubber, or equivalent.

Provide bottom bar weather-stripping that is a minimum [1/16 inch](#) thick sheet of vinyl, neoprene rubber, or equivalent.

#### 2.2.1.8 Locking Devices

Ensure that the slide bolt engages through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

Provide a locking device assembly which includes cylinder lock, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

[ Provide a chain lock keeper suitable for a standard padlock.

#### ]2.2.1.9 Safety Interlock

Equip power-operated doors with a safety interlock switch to disengage power supply when the door is locked, or provide an operator with an internal lock sensing device to prevent the door opening when the door is locked.

#### 2.2.2 Hardware

Ensure that all hardware conforms to [ASTM A153/A153M](#), [ASTM A307](#), and [ASTM F568M](#).

##### 2.2.2.1 Guides

Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated. Provide guides with sufficient depth or incorporate a steel locking bar to retain the curtain in place under the wind pressure specified. Ensure curtain operates smoothly. Slot bolt holes for track adjustment. Securely attach guides to adjoining construction with not less than [3/8 inch](#) diameter bolts, spaced near each end and not over [30 inches](#) apart.

[ Ensure guides are roll-formed steel channel bolted to angle or structural grade, three angle assembly of [steel][stainless steel][aluminum] to form a



slot of sufficient depth to retain curtains in guides to achieve 20 psf windload standard. Guides may be provided with integral windlock bars and removable bottom bar stops.

] [Fabricate with [structural steel] [stainless steel] [aluminum] angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Flare the top of inner and outer guide angles outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

#### ] 2.2.2.2 Hood

Provide a hood with a minimum [ 24-gauge] [ aluminum 18-gauge B&S] [ galvanized] [ stainless steel] sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. The hood encloses the curtain coil and counterbalance mechanism.

[ Hoods for openings more than 12 feet in width must have intermediate support brackets to prevent excessive sag.] [Provide a weather baffle at the lintel or inside the hood of each exterior door.

#### ] 2.2.3 Counterbalancing Mechanism

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted, around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

##### 2.2.3.1 Brackets

Provide the manufacturer's standard mounting brackets with one located at each end of the counterbalance barrel conforming to ASTM A36/A36M. Provide brackets of hot-rolled steel.

[ Brackets will be of [ 3/16 inch] [ 1/4 inch] minimum thick steel plates, with permanently sealed ball bearings. Designed to enclose ends of coil and provide support of counterbalance pipe at each end.

##### ] 2.2.3.2 Counterbalance Barrels

Curtain must roll up on a barrel supported at head of opening on brackets and be balanced by a torsion spring system in the barrel. Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M or equivalent. Ensure the barrel is of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats. Limit barrel deflection to not more than 0.03 inch per foot of span under full load.

###### a. Barrel

Provide steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.

###### b. Spring Balance

Provide an oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Ensure that effort to operate

manually operated units does not exceed 25 lbs. At least 80 percent of the door weight must be counterbalanced at any position. Provide wheel for applying and adjusting spring torque.

#### 2.2.3.3 Spring Balance

Install one or more oil-tempered, heat-treated steel helical torsion springs within the barrel, capable of producing sufficient torque to assure easy operation of the door curtain. Provide and size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

#### 2.2.3.4 Torsion Rod for Counter Balance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

#### [2.2.3.5 Counterbalance Shaft Assembly

##### [ a. Barrel

Provide steel pipe capable of supporting the curtain load with maximum deflection of 0.03 inches per foot of width.

##### ]b. Spring Balance

Provide an oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Ensure that maximum effort to operate does not exceed 25 pounds. Provide wheel for applying and adjusting spring torque.

#### ]2.2.4 Manual Door Operators

##### [2.2.4.1 Manual Push-Up Door Operators

Provide lifting handles on both sides of door and counterbalance in a manner to provide easy operation while raising or lowering the curtain by hand. Adjust counterbalance mechanisms so that the required lift or pull for operation does not exceed 25 pounds unless another type of door operator is indicated. Provide pull-down straps or pole hooks on bottom rail of doors over 7 feet high.

##### ]2.2.4.2 Manual Chain-Hoist Door Operators

Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit [of at least a 3 to 1 ratio] [with a maximum lifting force of [ 25 lbf] [ 30 lbf]]. Required pull for operation cannot exceed 35 pounds. Chain must extend to within 3 feet of floor.

Provide chain hoists with a mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of galvanized steel. Ensure that the yield point of the chain is at least three times the required hand-chain pull.

Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M.

## ] 2.2.4.3 Manual Crank-Hoist Door Operators

Provide door operators which consist of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit with a maximum [ 25 lbf] [ 30 lbf] force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Gears must be high-grade gray iron, cast from machine-cut patterns.

## ] 2.2.5 Electric Door Operators

Provide electrical wiring and door operating controls conforming to the applicable requirements of NFPA 70 and UL 325. The door manufacturer must furnish automatic control and safety devices, including extra flexible type SO cable and spring-loaded automatic takeup reel or equivalent device, as required for proper operation of the doors. Conduit, wiring, and mounting of controls are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

[ Electrical materials, equipment, and devices for installation in hazardous locations, as defined by NFPA 70, must be specifically approved by Underwriters Laboratories or an independent testing agency using equivalent standards, for the particular chemical group and the class and division of hazardous location involved.

] Electric door-operator assemblies need to be the sizes and capacities recommended and provided by the door manufacturer for specified doors. Furnish complete assemblies with electric motors and factory-prewired motor controls, starter, gear reduction units, solenoid-operated brakes, clutch, remote-control stations, manual or automatic control devices, and accessories as required for proper operation of the doors.

Design the operators so that motors may be removed without disturbing the limit-switch adjustment and affecting the emergency auxiliary operators.

Provide a manual operator of crank-gear or chain-gear mechanisms with a release clutch to permit manual operation of doors in case of power failure. Arrange the emergency manual operator so that it may be put into and out of operation from floor level, and its use does not affect the adjustment of the limit switches. Provide an electrical or mechanical device that automatically disconnects the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

## 2.2.5.1 Door-Operator Types

[ Provide an operator mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.]

[ Provide an operator mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.]

[ Provide an operator mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.]

[ Provide a bench mounted operator mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.]

[ Provide a through-wall operator which is mounted on other side of wall from coil side of door.]

#### 2.2.5.2 Electric Motors

Provide motors which are the high-starting-torque, reversible, constant-duty electrical type with overload protection of sufficient torque and horsepower to move the door in either direction from any position. Ensure they produce a door-travel speed of not less than 8 nor more than 12 inches per second without exceeding the horsepower rating.

Provide motors which conform to NEMA MG 1 designation, temperature rating, service factor, enclosure type, and efficiency to the requirements specified. Motors must be suitable for operation on current of the characteristics indicated. [ Single-phase motors must not have commutation or more than one starting contact. ] [ Motor enclosures must be the drip-proof type or NEMA TEFC and TENV type. ] Install motors in approved locations.

[Certify and label explosion-proof motors to indicate conformance to the following:

[UL 674, Class I, Groups C and D]

[UL 674, Class II, Groups F and G]

#### 2.2.5.3 Motor Bearings

Select bearings with bronze-sleeve or heavy-duty ball or roller antifriction type with full provisions for the type of thrust imposed by the specific duty load.

Pre-lubricate and factory seal bearings in motors less than 1/2 horsepower.

Equip motors coupled to worm-gear reduction units with either ball or roller bearings.

Equip bearings in motors 1/2 horsepower or larger with lubrication service fittings. Fit lubrication fittings with color-coded plastic or metal dust caps.

In any motor, bearings that are lubricated at the factory for extended duty periods do not need to be lubricated for a given number of operating hours. Display this information on an appropriate tag or label on the motor with instructions for lubrication cycle maintenance.

#### 2.2.5.4 Motor Starters, Controls, and Enclosures

Provide each door motor with: a factory-wired, unfused, disconnect switch; a reversing, across-the-line magnetic starter with thermal overload protection; 24-volt operating coils with a control transformer limit switch; and a safety interlock assembled in a NEMA ICS 6 type enclosure as specified herein. Ensure control equipment conforms to NEMA ICS 1 and NEMA ICS 2.

Provide adjustable switches, electrically interlocked with the motor controls and set to stop the door automatically at the fully open and fully closed position.

#### 2.2.5.5 Control Enclosures

Provide control enclosures that conform to NEMA ICS 6 for [NEMA Type 4] [NEMA Type 4X] [general purpose NEMA Type 1]. [oil-tight and dust-tight NEMA Type 12.] [explosion-proof, NEMA Type 7, group as indicated.] [explosion-proof NEMA Type 9, group as indicated.]

#### 2.2.5.6 Transformer

Provide starters with 230/460 to 115 volt control transformers with one secondary fuse when required to reduce the voltage on control circuits to 24volts or less. Provide a transformer conforming to NEMA ST 1.

#### 2.2.5.7 Sensing-Edge Device

Provide each door with a pneumatic or electric sensing device that meets UL 325, extends the full width of the door, and is located within a U-section neoprene or rubber astragal, mounted on the bottom rail of the bottom door section. Device needs to immediately stop and reverse the door upon contact with an obstruction in the door opening or upon failure of the device or any component of the control system and cause the door to return to its user-defined open position. Any momentary door-closing circuit must be automatically locked out and the door must be operable manually or with constant pressure controls until the failure or damage has been corrected. A sensing device is not a substitute for a limit switch.

Connect sensing device to the control circuit through a retracting cord and reel.

#### 2.2.5.8 Remote-Control Stations

[ Remote control stations must be at least 5 feet above the floor line, and all switches must be located so that the operator will have complete visibility of the door at all times. Provide interior remote control stations that are full-guarded, momentary-contact three-button, heavy-duty, surface-mounted NEMA ICS 6 type enclosures as specified. Mark buttons "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" buttons must be of the type requiring only momentary pressure to operate. The "CLOSE" button must be of the type either requiring constant pressure to maintain the closing motion of the door or momentary pressure when installed with a monitored entrapment detection device which, upon failure of the device or any component of the control system, cause the door to return to its full open position. When the door is in motion and the "STOP" button is pressed, ensure the door stops instantly and remains in the stopped position. From the stopped position, the door may then be operated in either direction by the "OPEN" or "CLOSE" buttons. When the door is in motion, and the "CLOSE" button of the constant pressure type is released, the door must stop and remain in the stop position or reverse to the user set up position; from the stop position, the door may then be operated in either direction by the "OPEN" or "CLOSE" buttons. Controls must be adjustable to automatically stop the doors at their fully open and closed positions. Open and closed positions must be readily adjustable.]

[ Provide exterior control stations that are full-guarded, momentary-contact

three-button standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosures, key-operated, with the same operating functions as specified herein for interior remote-control stations.]

#### 2.2.5.9 Speed-Reduction Units

Provide speed-reduction units consisting of hardened-steel worm and bronze worm gear assemblies or planetary gear reducers running in oil or grease and inside a sealed casing, coupled to the motor through a flexible coupling. Drive shafts need to rotate on ball- or roller-bearing assemblies that are integral with the unit.

Provide minimum ratings of speed reduction units in accordance with AGMA provisions for class of service.

Ground worm gears to provide accurate thread form; machine teeth for all other types of gearing. Surface harden all gears.

Provide antifriction type bearings equipped with oil seals.

#### 2.2.5.10 Chain Drives

Provide roller chains that are a power-transmission series steel roller type conforming to ASME B29.400, with a minimum safety factor of 10 times the design load.

Heat-treat or otherwise harden roller-chain side bars, rollers, pins, and bushings.

Provide high-carbon steel chain sprockets with machine-cut hardened teeth, finished bore and keyseat, and hollow-head setscrews.

#### 2.2.5.11 Brakes

Provide 360-degree shoe brakes or shoe and drum brakes. Ensure the brakes are solenoid-operated and electrically interlocked to the control circuit to set automatically when power is interrupted.

#### 2.2.5.12 Clutches

Ensure clutches are friction type or adjustable centrifugal type.

#### 2.2.5.13 Weather/Smoke Seal Sensing Edge

Provide automatic stop control by an automatic sensing switch within neoprene astragal extending the full width of door bottom bar.

Provide an electric sensing edge device. Ensure the door immediately stops downward travel when contact occurs before door fully closes. Provide a self-monitoring sensing edge connection to the motor operator.

#### 2.2.6 Fire-Rated Door Assembly

Provide fire-rated door assemblies with the dimensions, fire rating, and operating type indicated with electric operators and assemblies that do not interfere with manufacturer's standard interconnecting fusible links. Equip fire doors with an automatic closing mechanism. Doors must be forced into a closed position at a rate of descent of not more than 2 feet per second and not less than 6 inches per second without impact. The curtain

must be held against the sill until the release mechanism has been reset. The automatic closing mechanism must not interfere with normal operation of the door.

[ Provide the door manufacturer's standard interconnecting fusible links for door assemblies on both sides of the wall opening.

#### ]2.2.6.1 Fire Ratings

Provide fire-rated door assemblies complying with NFPA 80 Standard for Fire Doors and Other Opening Protectives. Fire doors must be complete with hardware, accessories, and automatic closing device as required by NFPA 80.

#### 2.2.7 Surface Finishing

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

##### 2.2.7.1 Galvanized and Shop-Primed Finish

Surfaces specified must have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating must conform to ASTM A653/A653M, coating designation Z275 (G90), for steel sheets[, except that hoods located on interior of the building may be Z180 (G60)], and ASTM A123/A123M for iron and steel products. The weight of coatings for products must be as designated in Table I of ASTM A123/A123M for the thickness of base metal to be coated. The prime coat must be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces by the materials and methods conforming to ASTM A780/A780M and spot prime. At the option of the Contractor, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel top coat may be applied to slats and hoods before forming, in lieu of prime coat specified.

##### 2.2.7.2 Baked-Enamel or Powder-Coat Finish

Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with the coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, ensure doors are free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the Contract Documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible

routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

### 3.1.1 Field Painted Finish

Ensure field painted steel doors and frames are in accordance with Section 09 90 00 PAINTS AND COATINGS and the manufacturer's written instructions. Protect the weather stripping from paint. Ensure that the finishes are free of scratches or other blemishes.

## 3.2 ADJUSTING AND CLEANING

### 3.2.1 Acceptance Provisions

After installation, adjust the hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide a weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to the manufacturer's written instructions.

Test the door opening and closing operation when activated by controls[ or alarm-connected fire-release] system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset the door-closing mechanism after a successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

#### 3.2.1.1 Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, examine, lubricate, test, and re-adjust doors as required for proper operation.

#### 3.2.1.2 Cleaning

Clean doors in accordance with manufacturer's approved instructions.

-- End of Section --



## SECTION 08 34 01

## FORCED ENTRY RESISTANT COMPONENTS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 500-D (2018) Laboratory Methods of Testing  
Dampers for Rating

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System  
for Aluminum Finishes

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding  
Code - Steel

ASM INTERNATIONAL (ASM)

ASM STFA (2001; 6th Ed) The Surface Treatment and  
Finishing of Aluminum and Its Alloys (2  
Vol.)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc  
(Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel  
Sheet, Zinc-Coated (Galvanized) or  
Zinc-Iron Alloy-Coated (Galvannealed) by  
the Hot-Dip Process

ASTM C1036 (2021) Standard Specification for Flat  
Glass

ASTM C1048 (2018) Standard Specification for  
Heat-Strengthened and Fully Tempered Flat  
Glass

ASTM C1172 (2019) Standard Specification for  
Laminated Architectural Flat Glass

ASTM D256 (2010; R 2018) Standard Test Methods for  
Determining the Izod Pendulum Impact  
Resistance of Plastics

ASTM D542	(2014) Index of Refraction of Transparent Organic Plastics
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D882	(2012) Tensile Properties of Thin Plastic Sheeting
ASTM D905	(2008; E 2009) Strength Properties of Adhesive Bonds in Shear by Compression Loading
ASTM D1003	(2013) Haze and Luminous Transmittance of Transparent Plastics
ASTM D1044	(2019) Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion by the Taber Abraser
ASTM D1922	(2015; R 2020) Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method
ASTM D3595	(2014) Polychlorotrifluoroethylene (PCTFE) Extruded Plastic Sheet and Film
ASTM D3951	(2018) Commercial Packaging
ASTM D4093	(1995; R 2014) Photoelastic Measurements of Birefringence and Residual Strains in Transparent or Translucent Plastic Materials
ASTM D4802	(2016) Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet
ASTM D5420	(2016) Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Strike Impacted by a Falling

## Weight (Gardner Impact)

ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E169	(2016) Standard Practices for General Techniques of Ultraviolet-Visible Quantitative Analysis
ASTM E831	(2014) Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM F428	(2019) Intensity of Scratches on Aerospace Glass Enclosures
ASTM F520	(2021) Standard Test Method for Environmental Resistance of Aerospace Transparencies to Artificially Induced Exposures
ASTM F521	(2022) Standard Test Methods for Bond Integrity of Transparent Laminates
ASTM F548	(2019) Standard Test Method for Intensity of Scratches on Aerospace Transparent Plastics
ASTM F735	(2022) Standard Test Method for Abrasion Resistance of Transparent Plastics and Coatings Using the Oscillating Sand Method
ASTM F791	(1996; R 2013) Stress Crazing of Transparent Plastics
ASTM F1233	(2021) Standard Test Method for Security Glazing Materials and Systems
ASTM G155	(2021) Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2021) Butts and Hinges
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.5	(2020) Cylinder and Input Devices for Locks
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000

ANSI/BHMA A156.16 (2018) Auxiliary Hardware  
 ANSI/BHMA A156.18 (2020) Materials and Finishes  
 ANSI/BHMA A156.115 (2016) Hardware Preparation in Steel Doors and Steel Frames

## GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (2008) Glazing Manual

## H.P. WHITE LABORATORY (HPW)

HPW TP-0500.03 (2003) Transparent Materials for use in Forced Entry or Containment Barriers

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 801 (2012; R 2018) Glossary of Terms for Hollow Metal Doors and Frames

NAAMM HMMA 802 (2007) Manufacturing of Hollow Metal Doors and Frames

NAAMM HMMA 810 (2009) Hollow Metal Doors

NAAMM HMMA 820 (2008) Hollow Metal Frames

NAAMM HMMA 830 (2002) Hardware Selection for Hollow Metal Doors and Frames

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2022) Standard for Fire Doors and Other Opening Protectives

NFPA 80A (2022) Recommended Practice for Protection of Buildings from Exterior Fire Exposures

## U.S. DEPARTMENT OF STATE (SD)

SD Std-01.01 (1993 Rev G Amended; Inx Certified Prod/Mfg) Certification Standard Forced Entry and Ballistic Resistance of Structural Systems

## UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint May 2020) Fire Tests of Door Assemblies

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G[, [\_\_\_\_\_]]

SD-03 Product Data

Forced Entry Resistant Components

Installation

Components

SD-07 Certificates

Forced Entry Resistant Components; G[, [\_\_\_\_\_]]

1.3 QUALITY ASSURANCE

Qualify welding procedures, welders, and welding operators in accordance with AWS D1.1/D1.1M. Forced entry resistant components must be certified as resistant to the forced entry test standards indicated herein. Test forced entry resistant components as specified below. The test results and certification thereof must be approved by the Contracting Officer before delivery of the component to the job site.

Component	Test Standard	Level Within Test Standard (If	Minimum Attack Time (Minutes)
[_____]	ASTM F1233	Class IV	Variable
[_____]	ASTM F1233	Class V	Variable
[_____]	HPW TP-0500.03	Prolonged	180
[_____]	HPW TP-0500.03	Level II	Variable
[_____]	HPW TP-0500.03	Level III	Variable
[_____]	HPW TP-0500.03	Level IV	Variable
[_____]	HPW TP-0500.03	Level V	Variable
[_____]	SD Std-01.01	5 Minute	5
[_____]	SD Std-01.01	15 Minute	15
[_____]	SD Std-01.01	60 Minute	60

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver Components to the job site with the manufacturer's name, and model number clearly marked thereon. Deliver, store, and handle components so as not to be damaged or deformed and in accordance with ASTM D3951. Carefully handle components to prevent damage to the faces, edges, corners, ends, and glazing where applicable. Clean, repair, or replace immediately abraded, scarred, or rusty areas upon detection of the damage. Replace damaged components that cannot be restored. Store components and equipment in a

dry location on platforms or pallets that are ventilated adequately, free of dust, water, and other contaminants, and stored in a manner which permits easy access for inspection and handling. Submit lists including schedule of components to be incorporated in the work with manufacturer's model or catalog numbers, specification and drawing reference numbers, warranty information, threat level designated, [fire ratings,] [sound transmission coefficient ratings,] [insulation "U" value,] and number of items provided. Listing of similar products that have been satisfactorily in use for two years or more, including name of purchasers, locations of installations, dates of installations, and service organizations.

#### 1.5 SEQUENCING AND SCHEDULING

When testing of a previously untested component is specified, allow sufficient lead time so that testing will not delay construction. The test results and component must be approved by the Contracting Officer before delivery of the component to the job site.

#### 1.6 WARRANTY

Furnish manufacturer's warranty for [\_\_\_\_\_] [5] years for glazing materials. Warranty must provide for replacement and installation of glazing if delamination, discoloration, or cracking or crazing occurs.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

##### 2.1.1 General Requirements

Components covered in this specification are designed to resist forced entry attacks with increasing severity levels of hand, power, and thermal tools and weapons and explosives. The components include forced entry resistant [personnel door/frame assemblies] [louvers] [windows] [glazing for doors] [pass-through drawers] [prefabricated guardhouses]. Each type of forced entry resistant component must be a complete assembly produced by a single manufacturer. Provide movable and operable components that operate smoothly and freely. Design items for exterior installation to resist water and vapor penetration or entrapment. Submit manufacturer's descriptive data, installation instructions, and certificate and test report showing compliance with the specified forced entry test standard as specified in paragraph COMPONENT TEST REQUIREMENTS for all components. [Following approval of manufacturer's descriptive data, submit a schedule listing the items and components to be furnished.] Submit manufacturer's certificate indicating that compliance with the installation instructions [and drawings] will provide the specified degree of forced entry resistance.

##### 2.1.2 Other Submittal Requirements

Submit the following:

- a. Manufacturer's descriptive data and finish samples.
- b. The forced entry resistant door lock functions, for selection by the Contracting Officer.
- c. Airflow calculations for louvers.
- d. Manufacturer's certificates attesting that components conform to the

requirements on drawings and in specifications.

- e. Testing reports from independent testing laboratories indicating conformance to regulatory requirements.
- f. Certificate, in lieu of a label, for fire rated doors.
- g. Certificate indicating compliance with the requirements for doors of the type and fire rating class.
- h. Manufacturer certification that compliance with the installation instructions and/or drawings will provide the specified degree of forced entry resistance.

## 2.2 COMPONENTS

For each type of forced entry resistant component, provide the standard product of a manufacturer regularly engaged in the manufacture of such products and duplicate items that have been tested and approved in accordance with the forced entry test standard specified in paragraph COMPONENT TEST REQUIREMENTS.

## 2.3 FORCED ENTRY RESISTANT PERSONNEL DOOR AND FRAME ASSEMBLIES

Provide doors and frames that are factory fabricated assemblies of indicated sizes. Provide doors consisting of steel, hardened steel, or reinforced internally with steel shapes and clad with aluminum. Provide interior composition and reinforcement determined by the manufacturer. Install rubber silencers on door frames. Close top edges of exterior doors flush and seal against water penetration, insulate, and provide with weatherstripping and thresholds. Provide locks and hinges that are the same or equal in performance and number as the hardware used on the tested door. Provide manufacturer's lock and hardware as a complete assembly. Furnish frames from the door fabricator, with anchorage to wall construction completely specified as to number of anchors, anchor size, material, and length.

### 2.3.1 Fire Rated Doors

Provide fire rated doors at locations indicated. Provide door assemblies complying with the forced entry test standard specified and bearing the listing identification label of the Underwriters' Laboratories, Inc. or a nationally recognized testing laboratory that is qualified to perform tests of fire door assemblies in accordance with **UL 10B**, and that has a listing service for the tested assemblies. Door assemblies include door, hardware, frame, closers, and glazing. A certificate indicating that the units were inspected in accordance with **NFPA 80** and **NFPA 80A** may be furnished in lieu of label. For oversized doors, a certificate from Underwriters' Laboratories, Inc. or a nationally recognized testing laboratory may be furnished in lieu of label. State that oversized doors are manufactured in compliance with the requirements for doors of the type and fire rating class. Submit manufacturer's descriptive data.

### 2.3.2 Sound Rated Doors

Provide sound rated doors at locations indicated. Provide door assemblies complying with the forced entry test standard specified and consisting of door, hardware, frame, threshold, and adjustable gaskets. The assembly must have a laboratory Sound Transmission Class (STC) rating [of [\_\_\_\_]]

[as indicated] when tested in accordance with [ASTM E90](#). Submit manufacturer's descriptive data, test report, and certification of the test report showing compliance with the specified requirements.

### 2.3.3 Door and Frame Fabrication

The subsurfaces must be flat, parallel, and plumb after fabrication. Provide doors that are reinforced [and fully insulated] in accordance with manufacturer's design. Anchor door frames as specified by the door manufacturer. Coordinate the door manufacturer's requirements for welding to wall reinforcement or casting frame embedments into wall before wall is placed. Miter or cope steel door frames and weld at the corners with welds ground smooth. Where structural channel frames are used, specify the size, weight, stops, welding, and anchorage into surrounding construction and test along with the door as an assembly. Make any necessary reinforcements in the door and the frame in the factory. Drill and tap door and frame as required for the specified hardware. Miter or cope frame channels and weld at corners with full penetration groove welds. Dress smooth exposed welds. Manufacture hollow metal doors and frames in accordance with [NAAMM HMMA 801](#), [NAAMM HMMA 802](#), [NAAMM HMMA 810](#), and [NAAMM HMMA 820](#) as a standard of quality, and meet the specified forced entry testing standard.

### 2.3.4 Sidelight Frames and Door Glazing

Construct sidelight frames using forced entry resistant door frame sections. For glazing in door or sidelight, provide stop height and rabbet depth as required to accommodate the glazing material that is resistant to the forced entry test standard specified. Test the assembly with the specified glazing and stops installed. Exterior (attack side) glazing stops must be welded or integral to the frame. Provide removable interior (protected side) glazing stops attached with high-strength alloy steel machine screws with tamper-resistant heads or as required by the manufacturer. Glazing is specified in paragraph Forced Entry Resistant Glazing Materials.

### 2.3.5 Preparation for Hardware

Prepare doors and frames for hardware in accordance with [[NAAMM HMMA 830](#)] [manufacturer's instructions]. Drill and tap surface applied hardware in the field.

### 2.3.6 Hardware

Provide hardware for forced entry resistant door assemblies by the door assembly manufacturer to ensure a complete forced entry resistant assembly. Where test standard requires hardware to be tested with the door assembly, include locks and hinges in the labeling and/or test certification. Provide locks and hinges that are the same or equal in performance, quality, grade, and quantity as used on the successfully tested door assembly in accordance with the specified forced entry testing standard. Provide certification that the locks, latches, and hinges provide the same degree of forced entry resistance as required by the specified forced entry testing standard. Provide keying as specified in Section [08 71 00 DOOR HARDWARE](#).

#### 2.3.6.1 Locks and Latchsets

Submit available lock functions for selection of function by the Contracting Officer. Provide mortise lock and latchsets, as a minimum,



series 1000, operational Grade 1, Security Grade 1 or 1A, and conforming to [ANSI/BHMA A156.13](#). Provide strikes for mortise locks and latches (including deadbolt locks), as a minimum, conforming to [ANSI/BHMA A156.115](#) except strikes must be rectangular (without curved lip). Provide mortise-type locks and latches for doors 1-3/4 inches thick and over that have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks must have armored fronts. Mortise locks and latches must have full escutcheon, through-bolted, extruded stainless steel trim. Provide lock finish [630] [639] [652] in accordance with [ANSI/BHMA A156.18](#).

#### 2.3.6.2 Hinges

Provide steel doors and frames required to resist the "very low" or "low" threat severity level that are up to and including 7 feet 0 inches high must, as a minimum, equipped with three Grade 1 hinges in accordance with [ANSI/BHMA A156.1](#), minimum size 5 inches high, heavy, double, or triple weight as required for weight of door. For each additional 12 inches of door height beyond 7 feet 0 inches, provide a minimum of one more hinge. Provide hinges that are full mortise, half mortise, full surface, or half surface design as recommended by the manufacturer for frame and door design and tamperproof unless mounted on the protected side of the door. Hinges must have [pins as recommended by the manufacturer] [nonremovable pins] [security pins] [and be equipped with a safety stud]. Spot welding of hinge pin will not be acceptable. Provide hinge manufacturer's certification that the hinge supplied meets applicable test requirements for [ANSI/BHMA A156.1](#) type number of hinge specified and that the hinge is suitable for the size and weight of the door assembly on which it will be utilized. Continuous extra heavy-duty piano-type hinge sized to carry the weight of the door without sagging is permitted. If continuous piano-type hinges are provided with the door, furnish independent laboratory reports covering both the door weight capacity and a 2,500,000 cycle testing to match the [ANSI/BHMA A156.1](#) Grade 1 requirements. Furnish prime coated steel interior door hinges. Furnish nonferrous metal or stainless steel exterior door hinges.

#### 2.3.6.3 Electric Strikes

Where required, provide electric strikes conforming to [ANSI/BHMA A156.5](#) Grade 1. Furnish strike boxes with deadbolt and latch strikes for Grade 1. Provide [fail secure] [fail safe] strikes.

#### 2.3.6.4 Door Closers

Provide manufacturer's recommended Grade 1, extra heavy duty closers conforming to [ANSI/BHMA A156.4](#). Provide [600] [689] [690] [691] [692] door closer finish in accordance with [ANSI/BHMA A156.18](#).

#### 2.3.6.5 Door Stops and Holders

Provide extra heavy duty door stops [and holders] conforming to [[ANSI/BHMA A156.8](#), Type C08511 overhead surface mounted type] [[ANSI/BHMA A156.16](#), Type L11251 for floor mounted installation] [[ANSI/BHMA A156.16](#), Type L11271 for wall mounted installation] [\_\_\_\_\_].

#### 2.3.7 Frame Anchors

Provide jamb and head anchors with door/frame assembly as specified by the manufacturer and forced entry resistant to the same degree as the component. Coordinate concrete work with component manufacturers when the

manufacturer specifies frame anchors to be embedded into a concrete or concrete masonry unit surface during construction.

#### 2.3.8 Weatherstripping

Provide head and jambs of exterior doors with compression-type neoprene bulb or closed-cell neoprene adjustable type weatherstripping. Door stops must be weatherstripped with a surface-mounted sponge neoprene strip in bronze housing not less than 0.070 inch thick installed to make contact with the door. Install weatherstripping in conformance with the manufacturer's directions after completion of finish painting.

#### 2.3.9 Louvers for Doors

Where indicated, provide doors with full louvers or louver section. Insert sightproof louvers into the door. Do not use pierced louvers. Inserted louvers must be stationary and nonremovable from the attack side of forced entry resistant doors. [Insect screens must be removable type with 18 by 16 mesh aluminum or bronze cloth.] The free area of the total square feet of the louver must be [17 percent for channel style louvers] [39 percent for chevron style louvers (inverted angles at 1 inch on center)] [[\_\_\_\_\_] percent]. Provide louvers in accordance with AMCA 500-D airflow test; minimum airflow must be [[\_\_\_\_\_] percent for channel style] [[\_\_\_\_\_] percent for chevron style] [[\_\_\_\_\_] percent]. Submit airflow calculations and test data showing compliance.

### 2.4 FORCED ENTRY RESISTANT LOUVERS

Fabricate louvers and frames from steel shapes to the opening dimensions indicated. The free area of the total square feet of the louver must be [17 percent for channel style louvers] [39 percent for chevron style louvers (inverted angles at 1 inch on center)] [[\_\_\_\_\_] percent]. Test louver in accordance with AMCA 500-D airflow test; minimum airflow must be [[\_\_\_\_\_] percent for channel style] [[\_\_\_\_\_] percent for chevron style] [[\_\_\_\_\_] percent]. Submit airflow calculations and test data showing compliance.

### 2.5 FORCED ENTRY RESISTANT WINDOW ASSEMBLIES

Construct forced entry resistant window assemblies using forced entry resistant frame sections. Provide welded frame unit sized and shaped with minimum frame face dimensions of 2 inches. Provide frame anchorage as specified by the manufacturer and forced entry resistant to the same degree as the component. Provide top height and rabbet depth as required to accommodate the glazing material resistant to the forced entry test standard specified. Exterior (attack side) glazing stops must be welded to or integral to the frame. Interior (protected side) glazing stops must be removable stops attached with high-strength alloy steel machine screws with tamper-resistant heads, or as required by the manufacturer.

#### 2.5.1 Deal Trays

Provide nominal 12-3/4 inch wide by 1-5/8 inch high opening in sill of window frame [ and include a 6-1/2 inch steel writing ledge on exterior side of window] [ and provide with a weatherproof closure]. Provide deal tray of the same materials and finish, that is a welded subassembly of the window assembly, and conforming to specified forced entry requirements for the entire window assembly.

### 2.5.2 Speaking Apertures

Fabricate speaking apertures to allow passage of voice at normal speaking volume without distortion, and to resist the referenced forced entry resistant standard for [outdoor] [indoor] use. Speaking aperture must be a welded subassembly of the window assembly conforming to the specified requirements for the entire window assembly.

### 2.5.3 Forced Entry Resistant Glazing Material

Provide [glass,] [plastic,] [ or ] [composite] glazing material conforming to applicable requirements [ASTM C1036](#), [ASTM E1300](#), and [ASTM C1048](#). Test glazing materials in accordance with the applicable sections of the following test procedures: [ASTM D905](#), [ASTM D1003](#), [ASTM F428](#), [ASTM F548](#), [ASTM D4093](#), and [ASTM F520](#). Plastic glazing must be acrylic plastic sheets, polycarbonate plastic sheets, or approved equal. Plastic glazing must be smooth and clear on both sides. [Provide factory installed glazing material.] Cover factory-glazed components to protect them from damage during adjacent finish work.

#### 2.5.3.1 Laminated Glass

Provide laminated glass conforming to applicable sections of [ASTM C1172](#). Provide adhesive interlayer material for bonding glass to glass that is chemically compatible with surfaces which are to be bonded. Test materials selected for lamination purposes in accordance with the following testing procedures: [ASTM D905](#), [ASTM D1044](#), [ASTM F735](#), [ASTM D4093](#), [ASTM F521](#), [ASTM F520](#), and [ASTM D1003](#). Glass plies used in the lamination must be [annealed float glass conforming to Type I, quality q3, Class 1, [ASTM C1036](#) ] [or] [heat-strengthened or fully heat-tempered float glass, Condition A, Type I, quality q3, Class 1, [ASTM C1048](#)].

#### 2.5.3.2 Acrylic Plastic Sheets

Use acrylic plastic glazing sheets "as cast" and in stretching operations with improved moisture absorption resistance conforming to [ASTM D4802](#). Test acrylic materials in accordance with the applicable sections of the following testing procedures: [ASTM D256](#), [ASTM D5420](#), [ASTM D542](#), [ASTM D570](#), [ASTM D635](#), [ASTM D638](#), [ASTM D696](#), [ASTM D792](#), [ASTM D1003](#), [ASTM E831](#), [ASTM F791](#), and [ASTM G155](#).

#### 2.5.3.3 Polycarbonate Plastic Sheets

Provide laminated or solid, ultraviolet stabilized [flame resistant] [high abrasion resistant] polycarbonate plasticsheets conforming to [ASTM D3595](#). Test polycarbonate materials in accordance with the applicable sections of the following testing procedures: [ASTM D256](#), [ASTM D5420](#), [ASTM D792](#), [ASTM F735](#), [ASTM D1003](#), [ASTM D635](#), [ASTM D638](#), [ASTM D1044](#), [ASTM D882](#), [ASTM D1922](#), [ASTM D570](#), [ASTM F520](#), [ASTM E169](#), [ASTM G155](#), and [ASTM F791](#). Do not use polyvinyl butyral in contact with polycarbonate because its plasticizer may craze polycarbonate.

#### 2.5.3.4 Glass/Plastic Laminate Glazing

Provide glass/plastic laminated glazing materials consisting of glass/plastic laminated construction or glass-clad plastic "sandwich" construction conforming to applicable sections of [ASTM C1172](#).

#### 2.5.3.5 Glass/Plastic Air-Gap Glazing

Provide forced entry resistant glass/plastic air-gap glazing consisting of an assembly in which glass forms the exterior [and interior (protected side)] layer, separated by an air space from the laminated plastic plies. Glass plies must be [annealed float glass conforming to Type I, quality q3, Class 1, [ASTM C1036](#)] [or] [heat-strengthened or fully heat-tempered float glass, Condition A, Type I, quality q3, Class 1, [ASTM C1048](#)]. Provide plastic plies consisting of laminated ultraviolet stabilized polycarbonate sheets, conforming to paragraph Polycarbonate Plastic Sheets and/or acrylic sheets for use "as cast" and in stretching operations with improved moisture absorption resistance conforming to paragraph Acrylic Plastic Sheets.

#### 2.5.4 Adhesive Interlayer Materials

Provide adhesive interlayer material for bonding laminates (glass-glass, glass-plastic, or plastic-plastic bonds) that is chemically compatible with the surfaces bonded. Interlayer materials may be polyvinyl butyral, cast-in-place urethane, proprietary materials, sheet from urethane and other materials. Do not use polyvinyl butyral to bond polycarbonate. Provide adhesives conforming to [ASTM D905](#) and the manufacturer's recommendations.

#### 2.5.5 Sealants

Provide sealants for glazings that are chemically compatible with the glazing materials they are in contact with and have no deleterious effects to the glazing materials or to the adhesives used in glazing laminates. Sealants must conform to the glazing manufacturer's recommendations and the requirements of [GANA Glazing Manual](#).

#### 2.6 FORCED ENTRY RESISTANT PASS-THROUGH DRAWER

Fabricate pass-through drawer of steel and of the size indicated. Assembly must provide a weather resistant opening. Attachment to wall assembly must be in accordance with the manufacturer's recommendations. Finish must be [primed for painting] [satin stainless steel] [\_\_\_\_\_].

#### 2.7 FORCED ENTRY RESISTANT PREFABRICATED GUARDBOUSES

Provide guardhouse consisting of prefabricated, forced entry resistant, modular wall [and] [ceiling] [and floor] panels insulated to R-value of [\_\_\_\_\_] with [doors] [windows] [louvers] [gunports] and necessary connecting posts, hardware, and accessories. Submit complete enclosure. Components must be factory painted with rust inhibitive primer unless indicated otherwise. Dress smooth exposed welds. Workmanship must be rigid, neat in appearance, and free from defects. Guardhouse must be [of rain and weatherproof design.] [designed to be relocatable by [crane] [forklift].] Perform electrical work in accordance with local codes.

#### 2.8 ACCESSORIES

Provide accessories for the installation of components into the surrounding structure. Anchorage must be forced entry resistant to the same degree as the component. Install in accordance with the manufacturer's recommended instructions. Materials, parts, bolts, anchors, supports, braces, fasteners, and connections necessary for completion of the work.

#### 2.9 LABELING

Plainly and permanently label forced entry resistant components as to the applicable forced entry test standard and level within the test standard under which the component was tested and approved. Label must be visible only from the protected side after component installation and include the following information: (1) manufacturer's name or identifying symbol; (2) model number, control number, or equivalent; (3) date of manufacture with the week, month or quarter, and year (this may be abbreviated or be in a traceable code such as the lot number); (4) correct mounting position (by removable label); and (5) forced entry resistant rating by indicating the test standard, level within the test standard (if any), and minutes of attack time withstood (if variable in the standard).

## 2.10 SHOP/FACTORY FINISHING

Unless otherwise specified, shop finish all factory or manufactured components as indicated below.

### 2.10.1 Ferrous Metal

Clean surfaces of ferrous metal, except galvanized and stainless steel surfaces, and factory prime for painting. Provide finish painting in accordance with Section 09 90 00 PAINTS AND COATINGS. Prior to shop painting, clean surfaces with solvents to remove grease and oil and with power wire-brushing or sandblasting to remove loose rust, loose mill scale, and other foreign substances. Do not shop paint surfaces of items to be embedded in concrete.

### 2.10.2 Galvanizing

Items specified to be galvanized must be hot-dip processed after fabrication. Galvanize in accordance with ASTM A123/A123M or ASTM A653/A653M.

### 2.10.3 Aluminum

Unless otherwise specified, aluminum items must be standard mill finish. When anodic coatings are specified, coatings must conform to ASM STFA, with treatment to a coating thickness not less than that specified for protective and decorative type finish in AA DAF45. Items to be anodized must receive a polished satin finish pretreatment and a clear lacquer overcoat conforming to the above-referenced standard.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Field verify dimensions of rough openings for components and that surfaces of openings are level, plumb, and provide required clearances. Examine components for racking, twisting, and other malformation and corrected prior to installation. Replace damaged components that cannot be corrected. Protect surrounding work prior to installation of forced entry resistant components. Repair surrounding work, which is damaged as a result of the installation of forced entry resistant components, in an approved manner prior to acceptance. Protect glazed units from damage during adjacent work.

### 3.2 FABRICATION

Construct, assemble, weld, and equip components with all hardware and accessories required to complete the assembly in the shop of a competent fabricator.

### 3.3 FASTENERS

Fasteners exposed to view must match in color and finish and harmonize with the material to which fasteners are applied. Drill or neatly punch holes for bolts and screws. Reject work with poor matching holes. Conceal fasteners where practicable. Unless otherwise specified, provide fasteners conforming to Section 08 31 00 ACCESS DOORS AND PANELS.

### 3.4 CORROSION PROTECTION - DISSIMILAR MATERIALS

Give a protective coating to contact surfaces between dissimilar metals and aluminum surfaces in contact with concrete, masonry, pressure-treated wood, or absorptive materials subject to wetting in accordance with Section 09 90 00 PAINTS AND COATINGS.

### 3.5 INSTALLATION

The finished work must be free from defects. Install components plumb and level and secure rigidly in place. Install components in accordance with approved manufacturer's recommended instructions. Test operable parts of components for smooth operation in the presence of the Contracting Officer. Coordinate frame embedments into the construction where required by the component manufacturer. Replace or repair materials which incur damage as a result of adjacent finish work as specified above. Install glazing for window assemblies, which are not specified as factory glazed, in accordance with GANA Glazing Manual and the manufacturer's recommended instructions. Field glazing must occur only after concrete, masonry, ceiling, electrical, mechanical, plumbing and adjacent finish work has been completed. Properly install forced entry resistant door assemblies so that operating clearances and bearing surfaces conform to the manufacturer's instructions. Secure the bottom of door frames to the floor slab in accordance with the manufacturer's recommendations. Install weatherstripping and thresholds at exterior door openings to provide a weathertight installation. Submit Drawings showing (1) anchorage of components and appurtenances into the actual surrounding construction, (2) clearances for operation, and (3) hardware location and installation details. Submit complete drawings for forced entry resistant prefabricated guardhouses. Submit a copy of installation instructions and recommended cleaning and maintenance instructions.

### 3.6 MANUFACTURER'S FIELD SERVICES

Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the component specified. At the request of the Contracting Officer, the representative must supervise the installation, adjustment, and operation (if operable) of the component. The representative must be onsite [1] [2] [\_\_\_\_\_] working days.

### 3.7 ADJUSTING/CLEANING

Make adjustments to assure smooth operation. Provide units that are weathertight when closed and locked. Clean components in accordance with manufacturer's instructions. Use only cleanser recommended by the manufacturer to clean polycarbonate, plastic, and applied hardcoats.

-- End of Section --

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## SECTION 08 34 02

## BULLET-RESISTANT COMPONENTS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 500-D (2018) Laboratory Methods of Testing  
Dampers for Rating

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System  
for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for  
Anodized Architectural Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc  
(Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel  
Sheet, Zinc-Coated (Galvanized) or  
Zinc-Iron Alloy-Coated (Galvannealed) by  
the Hot-Dip Process

ASTM C1036 (2021) Standard Specification for Flat  
Glass

ASTM C1048 (2018) Standard Specification for  
Heat-Strengthened and Fully Tempered Flat  
Glass

ASTM C1172 (2019) Standard Specification for  
Laminated Architectural Flat Glass

ASTM D256 (2010; R 2018) Standard Test Methods for  
Determining the Izod Pendulum Impact  
Resistance of Plastics

ASTM D542 (2014) Index of Refraction of Transparent  
Organic Plastics

ASTM D570 (1998; E 2010; R 2010) Standard Test  
Method for Water Absorption of Plastics

ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D882	(2012) Tensile Properties of Thin Plastic Sheeting
ASTM D905	(2008; E 2009) Strength Properties of Adhesive Bonds in Shear by Compression Loading
ASTM D1003	(2013) Haze and Luminous Transmittance of Transparent Plastics
ASTM D1044	(2019) Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion by the Taber Abraser
ASTM D1922	(2015; R 2020) Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method
ASTM D3595	(2014) Polychlorotrifluoroethylene (PCTFE) Extruded Plastic Sheet and Film
ASTM D3951	(2018) Commercial Packaging
ASTM D4093	(1995; R 2014) Photoelastic Measurements of Birefringence and Residual Strains in Transparent or Translucent Plastic Materials
ASTM D4802	(2016) Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet
ASTM D5420	(2016) Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Strike Impacted by a Falling Weight (Gardner Impact)
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E169	(2016) Standard Practices for General Techniques of Ultraviolet-Visible Quantitative Analysis
ASTM E204	(1998; R 2007) Identification of Material by Infrared Absorption Spectroscopy, Using the ASTM Coded Band and Chemical Classification Index
ASTM E831	(2014) Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM F428	(2019) Intensity of Scratches on Aerospace Glass Enclosures
ASTM F520	(2021) Standard Test Method for Environmental Resistance of Aerospace Transparencies to Artificially Induced Exposures
ASTM F521	(2022) Standard Test Methods for Bond Integrity of Transparent Laminates
ASTM F548	(2019) Standard Test Method for Intensity of Scratches on Aerospace Transparent Plastics
ASTM F735	(2022) Standard Test Method for Abrasion Resistance of Transparent Plastics and Coatings Using the Oscillating Sand Method
ASTM F791	(1996; R 2013) Stress Crazing of Transparent Plastics
ASTM F1233	(2021) Standard Test Method for Security Glazing Materials and Systems
ASTM G155	(2021) Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2021) Butts and Hinges
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.5	(2020) Cylinder and Input Devices for Locks
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.16	(2018) Auxiliary Hardware

ANSI/BHMA A156.18	(2020) Materials and Finishes
ANSI/BHMA A156.115	(2016) Hardware Preparation in Steel Doors and Steel Frames
GLASS ASSOCIATION OF NORTH AMERICA (GANA)	
GANA Glazing Manual	(2008) Glazing Manual
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM HMMA 810	(2009) Hollow Metal Doors
NAAMM HMMA 820	(2008) Hollow Metal Frames
NAAMM HMMA 830	(2002) Hardware Selection for Hollow Metal Doors and Frames
NAAMM HMMA 840	(2017) Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames
NAAMM HMMA 850	(20140) Fire Rated Hollow Metal Doors and Frames
NAAMM HMMA 862	(2013) Guide Specifications for Commercial Security Hollow Metal Doors and Frames
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NATIONAL INSTITUTE OF JUSTICE (NIJ)	
NIJ Std 0108.01	(1985) Ballistic Resistant Protective Materials

NAVAL FACILITIES ENGINEERING AND EXPEDITIONARY WARFARE CENTER  
(NAVFAC EXWC)

NAVFAC EXWC CR 80.025 (1980) Testing and Evaluation of Attack Resistance and Hardening Retrofits of Marine Barrack Construction Types to Small Arms Multiple Impact Threat

## U.S. DEPARTMENT OF STATE (SD)

SD Std-01.01 (1993 Rev G Amended; Inx Certified Prod/Mfg) Certification Standard Forced Entry and Ballistic Resistance of Structural Systems

## UNDERWRITERS LABORATORIES (UL)

UL 752 (2005; Reprint Jan 2021) UL Standard for Safety Bullet-Resisting Equipment

## 1.2 SYSTEM DESCRIPTION

## 1.2.1 Design Requirements

Provide bullet resistant components conforming to the requirements specified for the particular items and, as much as possible, complete assemblies by a single manufacturer.

## 1.2.2 Performance Requirements

Specify all bullet resistant items to the threat specified. Operate movable and operable components smoothly and freely. When a reference for performance is listed, conform to referenced requirements.

## 1.2.3 Submittal Requirement Details

Submit the following:

- a. Manufacturer's descriptive data and installation instructions. Include cleaning instructions as recommended by the plastic sheet manufacturer.
- b. Spare parts data for each bifold door, after approval of the related submittals, and not later than [\_\_\_\_\_] months prior to the date of beneficial occupancy. Include a complete list of parts and supplies, with current unit prices and supply source.
- c. Air flow calculations for louvers and louvers in doors.
- d. Lists including schedule of all components to be incorporated in the work with manufacturer's model or catalog numbers, specification and drawing reference numbers, warranty information, threat level certified, [fire ratings,] [sound transmission coefficient ratings,] [insulation "U" value,] and number of items provided.
- e. Evidence that standard products essentially duplicate items that have been satisfactorily in use for two years or more, including name of purchasers, locations of installations, dates of installations, and service organizations.

- f. Manufacturer's certificates attesting that all components conform to the requirements on drawings and in specifications. Include testing reports from independent testing laboratories indicating conformance to regulatory requirements.

[Six] [\_\_\_\_\_] copies of operation and [six] [\_\_\_\_\_] copies of maintenance manuals for the bifold doors furnished. The manuals must be approved prior to beneficial occupancy.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Installation; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Bullet Resistant Components

Bifold Doors

#### SD-07 Certificates

Bullet Resistant Components

#### SD-10 Operation and Maintenance Data

Bullet Resistant Components; G[, [\_\_\_\_\_]]

### 1.4 QUALITY ASSURANCE

Provide **Bullet-resistant components** at locations shown on the drawings. Bullet-resistant components [where indicated] [\_\_\_\_\_] must be in accordance with [[NIJ Type I] [NIJ Type IIA] [NIJ Type II] [NIJ Type IIIA] of **NIJ Std 0108.01.**] [[UL MPSA] [UL HPSA] [UL SPSA] [UL HPR] of **UL 752.**] [[ASTM Submachine Gun] [ASTM Handgun (.44 Magnum)] [ASTM Handgun (.38 Super)] [ASTM Rifle (.44 Magnum)] [ASTM Rifle (AP)] of **ASTM F1233.**] [[HPW Minimum Standard] [HPW Rifle Standard] [HPW Rifle AP Standard].] [[SD Submachine Gun (S)] [SD Military Rifle (R)] [SD Rifle (AP)] of **SD Std-01.01.**] [the test requirement of [NFESC SAMIT] [NFESC SAMIT (AP)] of **NAVFAC EXWC CR 80.025.**]

### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver components to the job site with the brand, name, and model number clearly marked thereon. Deliver, store and handle all components so as not to be damaged or deformed, and in accordance with **ASTM D3951**. Handle doors, windows, and louvers carefully to prevent damage to the faces, edges, corners, ends, and glazing. Clean, repair, or replace abraded, scarred, or rusty areas immediately upon detection. Replace damaged components that cannot be restored to like-new condition. Store components

and equipment in a dry location on platforms or pallets that are ventilated adequately, free of dust, water, and other contaminants, and stored in a manner which permits easy access for inspection and handling.

#### 1.6 SCHEDULING

Glaze bullet-resistant windows, except factory-glazed units, after all concrete, masonry, ceiling, electrical, mechanical, plumbing and adjacent finish work is complete to avoid damage to the glazing material. Cover factory-glazed windows to protect them from damage during adjacent finish work.

#### 1.7 WARRANTY

Furnish manufacturer's warranty for [\_\_\_\_\_] [5] years for glazing materials. Provide for replacement and installation of glazing if delamination, discoloration, or cracking, or crazing occurs.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND COMPONENTS

Provide materials and components which are the standard products of a manufacturer regularly engaged in the manufacture of such products, unless otherwise indicated and detailed on the drawings, and that essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening. Provide components supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site, or by the manufacturer. Where components are detailed on the drawings and do not conform to a manufacturer's standard product, provide components that are constructed of manufacturer's standard materials which conform to the specified ballistic standard or test. Provide bullet-resistant component assemblies of size and type indicated and provide at locations shown. Design all items included for exterior installation to resist water penetration or entrapment.

#### 2.2 ELECTRICAL WIRING

Provide electrical wiring and conduit as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### 2.3 BULLET-RESISTANT STEEL PERSONNEL DOORS

Provide factory fabricated door/frame assemblies, designed to be bullet resistant to the specified threat level, and conforming to applicable requirements of NAAMM HMMA 810, NAAMM HMMA 820, NAAMM HMMA 862, this section, and requirements indicated on drawings. Provide frames furnished by the door fabricator. Provide door silencers to cushion the impact of the door on the frame so that steel to steel contact is not made during closing. Completely weatherstrip, weatherproof, and fully insulate exterior doors. Exterior doors must close at flush top and bottom edges. Seal tops of doors against water penetration.

##### 2.3.1 Fire Rated Doors

Provide fire rated doors at locations shown on the drawings. Furnish door assemblies bearing the identifying label of the Underwriters Laboratories, or a nationally recognized testing agency qualified to perform certificate programs, indicating that the units conform to the requirements for Special

Purpose Type Fire Doors in accordance with NFPA 80. Construct fire rated doors in accordance with NAAMM HMMA 850. Certificate may be furnished in lieu of label. For oversized fire doors, state that doors are manufactured in compliance with the requirements for doors of this type and class, and have been tested and meet the requirements for the class indicated.

#### 2.3.2 Sound Rated Doors

Provide sound rated doors at locations shown on the drawings. Furnish door assemblies consisting of door, hardware, frame, threshold, and adjustable gaskets. The assembly must have a Sound Transmission Class (STC) rating [of] [\_\_\_\_\_] [as shown on the drawings] when tested in accordance with ASTM E90. [Submit manufacturer's descriptive data, and certificate or test report showing compliance with the specified requirements.] [Perform a field test on the door assembly to determine if the STC is within 2 points of the equivalent laboratory tested product. If the test reveals a less than acceptable STC, replace the door assembly and test the new assembly to provide an acceptable rating.]

#### 2.3.3 Door and Frame Fabrication

Exercise special care during welding to prevent warping. Design stiffeners and attach interior armor plates such that heat-affected areas, which result from welding, do not allow a potential ballistic leak in product construction. Make subsurfaces flat, parallel, and plumb after fabrication. Construct doors and frames of [bullet-resistant steel] [or] [hollow metal with internal armoring] such that the completed assembly meets the specified regulatory requirements. Reinforce [and fully insulate] doors in accordance with manufacturer's design. Miter or cope steel door frames and weld at the corners with all welds ground smooth. Design corner assemblies to eliminate ballistic penetrable seams. Where structural channel frames are used, make stops of 1-1/2 inch by 5/8 inch bars welded or top screwed to the frame at not more than [6] [12] inch centers. Furnish countersunk screws. Place stops so that full contact with the frame will be assured. Make necessary reinforcements and drill and tap the frames as required for the hardware. Miter or cope frame channels and weld at corners with full penetration groove welds. Dress smooth exposed welds.

#### 2.3.4 Sidelight Frames

Construct sidelight frames using door frame sections as shown on the drawings. Provide stop height and rabbet depth as required to accommodate the bullet-resistant glazing material specified. Weld exterior (attack side) glazing stops or make integral to the frame. Provide removable interior (protected side) glazing stops attached with high-strength alloy steel machine screws with tamper-resistant heads.

#### 2.3.5 Preparation for Hardware

Prepare doors and frames for hardware in conformance with Section 08 71 00 DOOR HARDWARE, and NAAMM HMMA 830. Drill and tap frames for surface applied hardware in the field.

#### 2.3.6 Hardware

Furnish hardware for bullet-resistant door assembly provided by the door assembly manufacturer to ensure a complete bullet resistant assembly. Where test standard requires hardware to be tested with the door assembly,



include hardware in the labeling and/or test certification. Key as specified in Section 08 71 00 DOOR HARDWARE.

#### 2.3.6.1 Mortise Locks and Latchsets

Furnish mortise lock and latchsets that are series 1000, operational Grade 1, Security Grade 1 or 1A, functions as indicated in the Hardware Schedule, and conforming to ANSI/BHMA A156.13. Furnish strikes for all mortise locks and latches, including deadlocks, conforming to ANSI/BHMA A156.115 except provide rectangular strikes without lip for security doors. Provide mortise-type locks and latches for doors 1-3/4 inches thick and over that have adjustable bevel fronts or otherwise conforming to the shape of the door. Mortise locks must have armored fronts. Mortise locks and latches must have full escutcheon, thru-bolted, extruded stainless steel trim.

#### 2.3.6.2 Hinges

Equip all 7 feet - 0 inch high doors with a minimum of three Grade 1 hinges in accordance with ANSI/BHMA A156.1, minimum size 5 inches high, heavy, double or triple weight as required for weight of door, or a single, continuous extra-heavy-duty piano-type hinge sized to carry the weight of the door without sagging. For each additional 12 inches of door height beyond 7 feet - 0 inch, provide minimum of one more hinge. Equip doors greater than 7 feet - 0 inches with a minimum of four hinges. Provide hinges that are full mortise, half mortise, full surface or half surface design as recommended by manufacturer for frame and door design, and tamperproof or mount on the inside face of the door. Provide hinge manufacturer's certification that the hinge supplied meets all applicable test requirements of ANSI/BHMA A156.1, type, number of hinges specified, and that the hinge is suitable for the size and weight of the door assembly on which it will be utilized. If continuous piano-type hinges are provided with door, furnish independent laboratory reports covering both the door weight capacity and a 2,500,000-cycle testing to match ANSI/BHMA A156.1 Grade 1 requirements. Provide steel, prime coated interior door hinges. Provide nonferrous metal or stainless steel exterior door hinges.

#### 2.3.6.3 Electric Strikes

Provide electric strikes conforming to ANSI/BHMA A156.5, Grade 1. Furnish strike boxes with dead bolt and latch strikes for Grade 1.

#### 2.3.6.4 Door Closers

Provide extra heavy duty closers of size and type recommended by manufacturer, and Grade 1 in accordance with ANSI/BHMA A156.4. Provide door closer finish that is [600] [689] [690] [691] [692] in accordance with ANSI/BHMA A156.18.

#### 2.3.6.5 Door Stops and Holders

Provide extra heavy duty door stops [and holders] [Type C08511 in accordance with ANSI/BHMA A156.8] [[Type L11251] [and] [Type L11271] in accordance with ANSI/BHMA A156.16] [\_\_\_\_\_].

#### 2.3.7 Frame Anchors

Provide jamb anchors with door/frame assembly conforming to manufacturer's recommendations to ensure complete bullet-resistant assemblies. Make provisions to stiffen the top member of all spans over 3 feet. Extend the

bottom of the frames below the finish floorline and secure to the floor slab by means of angle clips and expansion bolts. Floor clips are not required for installation in pre-built or existing openings.

#### 2.3.8 Weatherstripping

Provide head and jambs with compression-type neoprene bulb or closed-cell neoprene adjustable-type weatherstripping. Weatherstrip door stops with a surface-mounted sponge neoprene strip in bronze housing no less than 0.070 inch thick installed to make contact with the door. Install weatherstripping in conformance with the manufacturer's directions after completion of finish painting.

#### 2.3.9 Louvers for Doors

Where indicated, provide doors with full louvers or louver section. Louvers must be certified resistant to the same ballistic threat level as the rest of the door assembly. Insert sightproof louvers into the door. Do not use pierced louvers. Furnish inserted louvers that are stationary and nonremovable from the outside of exterior doors or the threat side of interior doors. [Provide removable insect screens with 18 by 16 mesh aluminum or bronze cloth.] [Where required by test standard, provide louvers with a spall-resistant screen of fine stainless steel mesh.] The free area of the total square feet of the louver must be [17 percent for channel style louvers] [39 percent for chevron style louvers (inverted angles at 1 inch on center)] [[\_\_\_\_\_] percent]. Submit louver that has been tested in accordance with AMCA 500-Dairflow test, with a minimum airflow of [[\_\_\_\_\_] percent for channel style] [[\_\_\_\_\_] percent for chevron style] [[\_\_\_\_\_] percent]. Submit airflow calculations and test data showing compliance.

#### 2.4 BULLET-RESISTANT LOUVERS

Fabricate louvers and frames from steel shapes to the opening dimensions indicated. Provide factory fabricated louver units designed to be bullet-resistant to the specified test standard in paragraph COMPONENT TEST REQUIREMENTS. Submit manufacturer's descriptive data, certificate, and test report showing compliance with the specified forced entry standard. The free area of the total square feet of the louver must be [17 percent for channel style louvers] [39 percent for chevron style louvers (inverted angles at 1 inch on center)] [[\_\_\_\_\_] percent]. Submit louver that has been tested in accordance with AMCA 500-D airflow test. Provide a minimum airflow of [[\_\_\_\_\_] percent for channel style] [[\_\_\_\_\_] percent for chevron style] [[\_\_\_\_\_] percent]. Submit airflow calculations and test data showing compliance.

#### 2.5 BULLET-RESISTANT STEEL BIFOLD DOORS, FRAMES, AND HARDWARE

Provide bifold doors consisting of two leaves per door, four per opening, as indicated on the drawings. Hardware must allow easy manual movement of doors. Provide doors and hardware that are either entirely jamb-supported or jamb-supported with floor rollers to reduce bearing load on hinges. Provide steel hinges of ample length to prevent sagging, and are through-bolted in accordance with manufacturer's instructions. Furnish operators and all installation hardware that is the product of a manufacturer which specifically designs and produces hardware for heavy-duty industrial-type doors. Factory prime door surfaces for painting and reinforced and prepared for hardware installation. [Bifold doors must be manually securable from the protected side through actuation of

surface-mounted cane bolt or similar device as recommended by manufacturer.] Maximum clearance at bottom of doors must be 1 inch. Provide exterior doors with weather seals at jambs, head, and sill.

#### 2.5.1 Testing

Subject bullet-resistant bifold door to testing by manufacturer to demonstrate appropriate design, strength, and application and operation of all hardware, both manual and electric. Perform door tests to replicate actual installation to the maximum extent possible. Coordinate arrangements with Contracting Officer as to time and location of tests. Tests must be witnessed and results subjected to approval by representatives of the Contracting Officer prior to delivery of the doors to the job site.

#### 2.5.2 Bifold Doors

Furnish bullet-resistant bifold doors complete with [pneumatic operators] [electric operators] [and other] accessories specified. Design the operator so that the motor may be removed without affecting emergency auxiliary operators. [Provide a manual operator of crank-gear or chain-gear mechanism to allow manual operation in case of power failure. Provide a device for locking the chain or crank.] Submit a copy of the instructions proposed to be framed and posted.

#### 2.5.3 Power Operators

Provide [pneumatic] [electric] type conforming to NFPA 80 and the requirements specified herein. Provide readily adjustable limit switches to automatically stop the door in its full open or closed position. [All operating devices must be suitable for the hazardous Class, Division, and Group shown, as defined in NFPA 70.]

##### 2.5.3.1 Pneumatic Operators

Provide pneumatic operators, heavy-duty industrial type designed to operate the door at not less than 8 inches nor more than one foot/second with air pressure of [\_\_\_\_\_] psi. Provide pressure regulator if operator is not compatible with previously specified air pressure. Provide dryer, filter, filter alarm, pneumatic piping up to connection with building compressed air, but not more than 20 feet from door jambs. Operators must have provision for immediate emergency manual operation of the door in case of failure. The operator must open, close, start, and stop the door smoothly. Control must be [electric, conforming to NEMA ICS 2 and NEMA ICS 6; enclosures must be Type 12 (industrial use), Type 7 or 9 in hazardous locations, or as otherwise indicated] [pneumatic] with [push button wall switches] [ceiling pull switches] [rollover floor treadle] as indicated.

##### 2.5.3.2 Electric Operators

Provide electric operators, heavy-duty industrial type designed to operate the door at not less than 8 inches nor more than 1 foot/second. Provide electrical controls that are [push button wall switches] [ceiling pull switches] [rollover floor treadle] as indicated. Provide electric power operators complete with electric motor, brackets, controls, limit switches, magnetic reversing starter, and all other accessories necessary. Design the operator so that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency operator. Provide

the power operator with a slipping clutch coupling to prevent stalling of the motor. Operators must have provisions for immediate emergency manual operation of the door in case of electrical failure. Where control voltages differ from motor voltage, provide a control voltage transformer in and as part of the starter. Provide control voltage of 120 volts or less.

- a. Motors: Provide drive motors conforming to NEMA MG 1, with high-starting torque, reversible type, and of sufficient horsepower and torque output to move the door in either direction from any position at the required speed without exceeding the rated capacity. Provide motors suitable for operation on [\_\_\_\_\_] volts, [60] [\_\_\_\_\_] hertz, [single] [three] phase, and suitable for across-the-line starting. Design all motors to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating.
- b. Controls: Provide an enclosed reversing across-the-line type magnetic starter having thermal overload protection, limit switches, remote control switches and conforming to NEMA ICS 2 for each door motor; provide enclosures that are NEMA ICS 6, Type 12 (industrial use), Type 7 or 9 in hazardous locations, or as otherwise indicated. Each wall control station must be of the three-button type, with the controls marked and color coded: OPEN - white; CLOSE - green; and STOP - red. When the door is in motion and the "STOP" control is pressed, the door must stop instantly and remain in the stop position; from the stop position, the door must be operable in either direction by the "OPEN" or "CLOSE" controls. Provide full-guarded controls to prevent accidental operation.

#### 2.5.4 Safety Device

Provide a safety device that will immediately reverse the door movement upon contact with an obstruction and cause the door to return to its full open position. Do not substitute the safety device for a limit switch. Provide exterior doors with a combination weather seal and safety device on the leading edge.

#### 2.6 BULLET-RESISTANT STEEL WINDOWS

Fabricate window assemblies from [bullet-resistant steel shapes] [or] [hollow metal with internal armoring] and bullet-resistant glazing materials specified herein; the entire assembly must meet or exceed the specified regulatory requirements. Provide welded frame units of sizes and shapes indicated on the drawings with minimum frame face dimensions of 2 inches. Furnish glazing material with window assembly for onsite installation, or furnish factory glazed window units. Entire assembly must be furnished by same manufacturer. Weld exterior (attack side) glazing stops or integral to frame. Provide removable interior (protected side) glazing stops attached with high-strength alloy steel machine screws with tamper-resistant heads.

##### 2.6.1 Glazing Materials

Provide factory fabricated units designed to be bullet-resistant to the specified test standard in paragraph COMPONENT TEST REQUIREMENTS. Glazing material must be [glass,] [plastic,] [or] [composite] with a [no-spall] [low-spall] protected (interior) face. [Low-spall interior face must meet or exceed requirements for spall resistance defined in UL 752.] Provide glazing material conforming to applicable requirements contained in

ASTM C1036, ASTM C1048, and ASTM E1300. Test glazing materials in accordance with the applicable sections of the following testing procedures: ASTM D905, ASTM D1003, ASTM F428, ASTM F548, ASTM D4093, and ASTM F520. Apply a hardcoat to all plastic glazing exposed to the interior or exterior environment.

#### 2.6.1.1 Laminated Glass

Provide bullet-resistant laminated glass consisting of all glass laminated construction conforming to applicable sections of ASTM C1172. The adhesive interlayer material for bonding glass to glass must be chemically compatible with the surfaces which are to be bonded. Test materials selected for lamination purposes in accordance with the following testing procedures: ASTM D905, ASTM D1044, ASTM F735, ASTM D4093, ASTM F521, ASTM F520, and ASTM D1003. Use glass plies in the lamination that are [annealed float glass conforming to Type I, quality q3 Class 1, in accordance with ASTM C1036] [or] [heat-strengthened or fully heat tempered, float glass, Condition A, Type I, q3 Class 1, in accordance with ASTM C1048].

#### 2.6.1.2 Acrylic Plastic Sheets

Use bullet-resistant acrylic plastic glazing sheets "as cast" and in stretching operations with improved moisture absorption resistance conforming to ASTM D4802. Test acrylic materials in accordance with the applicable sections of the following testing procedures: ASTM D256, ASTM D5420, ASTM D542, ASTM D570, ASTM D635, ASTM D638, ASTM D696, ASTM D792, ASTM D1003, ASTM E831, ASTM F791, and ASTM G155. Provide plastic glazing sheets that are clear and smooth on both sides.

#### 2.6.1.3 Polycarbonate Plastic Sheets

Provide bullet-resistant laminated polycarbonate sheets, ultraviolet stabilized, [flame resistant] [high abrasion resistant] sheets conforming to ASTM D3595. Test polycarbonate materials in accordance with the applicable sections of the following testing procedures: ASTM D256, ASTM D5420, ASTM D792, ASTM F735, ASTM D1003, ASTM D635, ASTM D638, ASTM D1044, ASTM D882, ASTM D1922, ASTM D570, ASTM F520, ASTM E169, ASTM E204, ASTM G155, and ASTM F791. Do not use polyvinyl butyral in contact with polycarbonate because its plasticizer may craze polycarbonate.

#### 2.6.1.4 Glass/Plastic Laminate Glazing

Furnish bullet-resistant glass/plastic laminated glazing materials consisting of glass/plastic laminated construction or glass-clad plastic "sandwich" construction conforming to applicable sections of ASTM C1172. Polycarbonate must be ultraviolet stabilized.

#### 2.6.1.5 Glass/Plastic Air-Gap Glazing

Furnish bullet-resistant glass/plastic air-gap glazing consisting of an assembly in which glass forms the exterior [and interior (protected side)] layer, separated by an air space from the laminated plastic plies. Provide exterior glass plies that are [annealed float glass conforming to Type I, quality q3 Class 1, in accordance with ASTM C1036] [or] [heat-strengthened or fully heat tempered, float glass, Condition A, Type I, q3 Class 1, in accordance with ASTM C1036] [or] [heat-strengthened or fully heat tempered, float glass, Condition A, Type I, q3 class 1, in accordance with ASTM C1048]. [Provide interior (protected side) glass plies that are [annealed float

glass conforming to Type I, quality q3 Class 1, in accordance with [ASTM C1036](#)] [or] [heat-strengthened or fully heat tempered, float glass, Condition A, Type I, q3 Class 1, in accordance with [ASTM C1048](#)].] [Where annealed glass is used on the protected side of the window, apply a sheet of 4 mil thick clear mylar fragment retention film to the interior surface in accordance with film manufacturer's instructions. Apply film that wraps around the edges of the glass prior to glazing the window.] Furnish plastic plies consisting of laminated ultraviolet stabilized polycarbonate sheets, conforming to paragraph Polycarbonate Plastic Sheets and/or acrylic sheets for use "as cast" and in stretching operations with improved moisture absorption resistance conforming to applicable requirements of paragraph Polycarbonate Plastic Sheets.

#### 2.6.2 Adhesive Interlayer Materials

Provide adhesive interlayer materials for bonding laminates (glass-glass, glass-plastic, or plastic-plastic bonds) that are chemically compatible with the surfaces being bonded. Interlayer materials may be polyvinyl butyral, cast-in-place urethane, proprietary materials, sheet form urethane and other materials. Do not use polyvinyl butyral to bond polycarbonate. Provide adhesives in accordance with [ASTM D905](#) and manufacturer's recommendations.

#### 2.6.3 Sealants

Furnish sealants for glazings that are chemically compatible with the glazing materials they contact with no deleterious effects to the glazing materials or to the adhesives used in laminates. Sealants must be in accordance with glazing manufacturer's recommendations and [GANA Glazing Manual](#).

#### 2.6.4 Deal Trays

Provide nominal 12-3/4 inch wide by 1-5/8 inch high opening in sill of window frame [and include a 6-1/2 inch steel writing ledge on exterior side of window]. Provide deal tray welded subassembly of window assembly conforming to specified requirements for entire window assembly. Provide opening configuration of deal tray that prevents ballistic penetration or spall from the threat weapon, and resists lead spray from a shotgun blast. Provide tray opening that prevents insertion of the muzzle of a firearm.

#### 2.7 BULLET-RESISTANT SPEAKING APERTURES

Fabricate speaking apertures to allow passage of voice at normal speaking volume without distortion, to resist the specified threat level for [outdoor] [indoor] use, and designed to prevent direct aim by the insertion of the muzzle of any firearm. Finish must match [window] [door] construction in which aperture is installed.

#### 2.8 BULLET-RESISTANT GUNPORTS

Operate only from the protected side of the barrier, with a protected side shutter that closes automatically and is lockable from the protected side. Fabricate gunport from bullet resistant steel shapes and the entire assembly must meet or exceed the specified regulatory requirements. Size gunport for operation using submachine guns and rifles. [Provide assembly with a weather resistant opening.] Provide hinged or pivoted shutter and do not obstruct operation when in open position. Attach to wall assembly in accordance with manufacturer's recommendations. Include all aspects of

gunport assembly, including hardware and method of anchorage to wall, in labeling or test certification. Provide [primed for painting] [satin stainless steel] finish. Gunport must not be operable from exposed side.

#### 2.9 BULLET-RESISTANT PASS-THROUGH DRAWER

Fabricate pass-through drawer from bullet-resistant steel shapes; the entire assembly must meet or exceed the specified regulatory requirements. Provide pass-through drawer of size indicated on the drawings and designed to prohibit forcible entry or direct aim by the insertion of the muzzle of a firearm from exterior side when drawer is in the open position. [Provide a weather resistant opening.] Attach to wall assembly in accordance with manufacturer's recommendations. Include all aspects of the assembly, including hardware and method of anchorage to wall, in the labeling or test certification. Provide [primed for painting] [satin stainless steel] finish.

#### 2.10 BULLET-RESISTANT PREFABRICATED MODULAR ENCLOSURE

Provide enclosure consisting of prefabricated, bullet-resistant, modular [insulated] wall [and] [ceiling] [and floor] panels with [doors,] [windows,] [louvers,] [gunports,] [and] all necessary connecting posts, hardware and accessories. Complete enclosure must be of minimum dimensions shown on the drawings. Provide [doors,] [windows,] [louvers,] [and] [gunports] in accordance with the requirements specified in those respective paragraphs. Components must be factory-welded assemblies. Factory paint all metal components with rust inhibitive primer unless indicated otherwise. Dress smooth all exposed welds. Workmanship must be rigid, neat in appearance, and free from defects. [Design enclosure to be relocatable by [crane] [forklift].]

#### 2.11 ACCESSORIES

Provide all accessories for the installation or erection of above components into the surrounding structure. Anchorage must be as strong and bullet-resistant as the components. Install/erect in accordance with manufacturer's recommended instructions.

#### 2.12 LABELING

Plainly [and permanently] label bullet-resistant equipment in accordance with regulatory requirements. Provide label that is compatible with plastic or coating, visible only on protected side, after installation, including the following information:

- a. Manufacturer's name or identifying symbol
- b. [Model Number, Control Number, or equivalent]
- c. Date of manufacture by week, month or quarter and year. This may be abbreviated or be in a traceable code such as the lot number.
- d. Correct mounting position including threat side and secure side (by removable label on glazing material).
- e. Code indicating bullet-resistant rating and test standard used (by removable label on glazing material).

#### 2.13 SHOP/FACTORY FINISHING

Furnish all ferrous metal components, except stainless steel, primed for painting unless indicated otherwise. Perform finish painting in accordance with Section 09 90 00 PAINTS AND COATINGS, unless otherwise indicated. When anodic coatings are specified, the coatings must conform to AAMA 611, with coating thickness not less than that specified for protective and decorative type finish in AA DAF45. Apply a polished satin finish pretreatment and a clear lacquer overcoat to anodized items. Shop finish all factory or manufactured components as indicated.

#### 2.13.1 Ferrous Metal

Clean surfaces of ferrous metal, except galvanized and stainless steel surfaces, and shop coat with the manufacturer's standard protective coating other than a bituminous protective coating, compatible with finish coats. Prior to shop painting, clean surfaces with solvents to remove grease and oil, and with power wire-brushing or sandblasting to remove loose rust, loose mill scale and other foreign substances. Do not shop paint surfaces of items to be embedded in concrete.

#### 2.13.2 Galvanizing

Items specified to be galvanized must be hot-dip processed after fabrication. Galvanize in accordance with ASTM A123/A123M or ASTM A653/A653M as applicable.

#### 2.13.3 Aluminum

Unless otherwise specified, aluminum items must be standard mill finish. For anodic coatings see paragraph SHOP/FACTORY FINISHING above.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Field verify dimensions of rough openings for components, and that surfaces of openings are plumb, true, and provide required clearances. Protect surrounding work prior to installation of bullet-resistant components. Restore surrounding work which is damaged as a result of the installation of bullet-resistant components to like-new condition prior to acceptance of the work described herein. Examine existing work to ensure that it is ready for installation or erection of the components. Check and correct components for racking, twisting, and other malformation prior to installation. Set frames true, plumb and aligned for proper installation. Examine all surfaces and connections for damage prior to installation.

#### 3.2 FRAMED INSTRUCTIONS

Post framed instructions, under glass or in plastic with all edges laminated, including wiring and control diagrams showing the complete layout of each bifold door unit, where directed. Prepare condensed operating instructions explaining preventive maintenance procedures, methods of checking for normal safe operation, and procedures for safely starting and stopping in typed form, frame as specified above and post beside the diagrams. Post the framed instructions before acceptance testing.

#### 3.3 INSTALLATION



Provide finished work that is rigid, neat in appearance and free from defects. Install equipment plumb, level, and secured rigidly in place. Install doors and frames conforming to NAAMM HMMA 840. Install doors, frames, and hardware in strict compliance with approved printed instructions and detail drawings provided by the manufacturer. The Contractor is responsible for proper installing of the door assembly so that operating clearances and bearing surfaces conform to manufacturer's instructions. Install weatherstripping and thresholds at exterior door openings to provide a weathertight installation. Install all other components in accordance with approved manufacturer's recommended instructions. Test all operable parts of components for smooth, trouble-free operation, in the presence of the Contracting Officer. Submit Drawings containing complete wiring and schematic diagrams, where appropriate, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show proposed layout and anchorage of components and appurtenances, and relationship to other parts of work including clearances for operation and maintenance. Show conformance to all requirements, including fabrication details, sizes, thickness of materials, anchorage, finishes, hardware location and installation.

#### 3.4 FASTENERS

Fasteners exposed to view must match in color and finish and must harmonize with the material to which fasteners are applied. Provide fasteners in accordance with Section 08 31 00 ACCESS DOORS AND PANELS.

#### 3.5 CORROSION PROTECTION - DISSIMILAR MATERIALS

Give contact surfaces between dissimilar metals and aluminum surfaces in contact with concrete, masonry, pressure-treated wood or absorptive materials subject to wetting, a protective coating in accordance with Section 09 90 00 PAINTS AND COATINGS.

#### 3.6 ELECTRICAL WORK

Perform all electrical work in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Make flexible connections between doors and fixed supports with extra flexible type SO cable, except in hazardous locations where wiring conforms to NFPA 70. Provide cable consisting of a spring-loaded automatic take up reel, or an equivalent and approved device.

#### 3.7 ADJUSTING/CLEANING

Make adjustments to doors and pass-thru drawers to assure smooth operation. Units must be weathertight when closed and locked. Clean all components in accordance with manufacturer's instructions.

-- End of Section --

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## SECTION 08 34 16

## CORROSION CONTROL HANGAR DOORS

05/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 325 (2017) Steel Construction Manual
- AISC 360 (2016) Specification for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

- AISI SG03-3 (2002; Suppl 2001-2004; R 2008)  
Cold-Formed Steel Design Manual Set

## AMERICAN LADDER INSTITUTE (ALI)

- ALI A14.3 (2008; R 2018) Ladders - Fixed - Safety Requirements

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- ASHRAE 52.2 (2012) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

## AMERICAN WELDING SOCIETY (AWS)

- AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

- ASTM A29/A29M (2020) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
- ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel
- ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A519/A519M (2017) Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing

ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM A1018/A1018M	(2016a) Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B88	(2020) Standard Specification for Seamless Copper Water Tube
ASTM B103/B103M	(2019) Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D740	(2011) Methyl Ethyl Ketone
ASTM D4614	(2011) Standard Specification for Ethyl Acetate (All Grades)
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE 519	(2014) Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM MBG 531	(2017) Metal Bar Grating Manual
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
NFPA 220	(2021) Standard on Types of Building Construction
NFPA 409	(2022) Standard on Aircraft Hangars

## SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-C-22542	(2012; Rev A; Stabilized (S) 2012) Cleaning Compound, High Pressure Cleaner, Liquid
SAE J514	(2012) Hydraulic Tube Fittings
SAE J1405	(2012) Optional Test Procedures for Hydraulic Hose Assemblies

## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-D-16791	(1990; Rev G, Am 1 1993; Notice 1 2020) Detergents, General Purpose (Liquid, Non-Ionic)
MIL-DTL-5541	(2006; Rev F) Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-DTL-15021	(2014; Rev B) Hook, Snap Bolt, Swivel-Eye, and Rings
MIL-R-24243	(1994; Rev C, Notice 1 2020) Rivets, Blind, Nonstructural, Retained Mandrel, Open End, Domed Head, Aluminum Alloy, Carbon Steel, Corrosion Resistant Steel
MIL-T-81772	(2019; Rev C) Thinner, Aircraft Coating

UFC 1-200-01 (2019; with Change 1, 2020) DoD Building Code

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-857 (Rev B, Notice 3) Thinner, Dope and Lacquer (Cellulose Nitrate)

FS RR-C-271 (Rev H; Am 1) Chains and Attachments, Carbon And Alloy Steel

UNDERWRITERS LABORATORIES (UL)

UL 900 (2015) Standard for Air Filter Units

## 1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, 03 30 00 CAST-IN-PLACE CONCRETE, 05 12 00 STRUCTURAL STEEL, 08 11 13 STEEL DOORS AND FRAMES, 08 71 00 DOOR HARDWARE, 43 15 00.00 20 LOW PRESSURE COMPRESSED AIR PIPING (NON-BREATHING AIR TYPE), 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES and 09 90 00 PAINTS AND COATINGS apply to this section with additions and modifications specified herein.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Manufacturer's Qualifications; G[, [\_\_\_\_\_]]

Installer's Qualifications; G[, [\_\_\_\_\_]]

### SD-02 Shop Drawings

Door Materials; G[, [\_\_\_\_\_]]

### SD-05 Design Data

Door Structure; G[, [\_\_\_\_\_]]

### SD-10 Operation and Maintenance Data

Lubrication; G[, [\_\_\_\_\_]]

Air System; G[, [\_\_\_\_\_]]

Electrical Equipment; G[, [\_\_\_\_\_]]

### 1.3.1 Door Materials

Submit design drawings covering door structure, all operating devices, mechanical systems and "U" value

Show all details for construction, installation and operation; size, shapes and thickness of materials, joints and connections; reinforcing; hardware; mechanical devices; electrical devices; and all design and detail data for work of other trades affected by hangar doors.

Submit the door manufacturer's complete schematic compressed air and wiring diagrams, field piping and wiring diagrams, and a complete physical location drawing showing the location of all pressure regulators, gages, metering valves, lubricators, filter-dryers, interlocking valves and controls with the runs of pipe and conduit, pipe size and conduit size, wire number and wire size in each conduit, junction box location and full control mounting details

### 1.3.2 Door Structure

Submit design calculations covering door structure, all operating devices, mechanical systems and "U" value. A Registered Professional Engineer shall prepare and sign structural calculations.

#### 1.3.2.1 Adjustable Frequency Motor Drive

IEEE 519.

### 1.3.3 Operation and Maintenance Manuals

Drawings and instructions showing all lubrication points, proper lubricants, lubrication frequency schedule and complete operating instructions. Complete compressed air system schematic and electrical equipment wiring diagrams.

Furnish the above in duplicate to the Contracting Officer.

## 1.4 QUALITY ASSURANCE

### 1.4.1 Manufacturer's Qualifications

Use a corrosion control hangar door product from a manufacturer who is regularly engaged in the design, fabrication, erection, and service of corrosion control hangar doors of type and size required for this project. The manufacturer shall have at least 5 years of similar corrosion control hangar door design experience. Similar doors must have comparable function and design including size, configuration, type of use, retractable or moving elements, safety features, controls, and other key engineering elements as the door being specified. It is acceptable to show that a series of similar doors collectively meet all comparable elements to the door being specified, although not necessarily individually. Manufacturer must submit written evidence on similar past door designs and installations listing the name, location, contact information of owners, installation dates, overall sizes, features, and other relevant information for experience and qualifications evaluation. Only manufacturers who can submit this evidence of actual installations where the products have proven practical, durable, and require a minimum of maintenance, will be qualified under this specification.

#### 1.4.2 Installer's Qualifications

Installation of the door(s) shall be supervised by a manufacturer's representative and shall be in accordance with approved shop drawings. Installers shall be skilled and experienced in the erection of corrosion control hangar doors of the type specified herein. Installers must submit written evidence of similar past door installations listing the name, locations, contacts information of owners, installation dates, overall sizes, features, and other relevant information for experience and qualifications evaluation.

#### 1.4.3 Warranty

The door manufacturer shall provide a three-year warranty for all mechanical and electrical components against defects in material and workmanship beginning on the date of Project Acceptance.

### 1.5 DELIVERY AND STORAGE

Deliver materials which are not shop-installed in the doors in original packages, containers, boxes or crates bearing the manufacturer's name, brand and model number. Store all materials and equipment in dry locations with adequate ventilation, free from dust or water, and to permit access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

### 1.6 DESIGN REQUIREMENTS

#### 1.6.1 Door Design and Components

The corrosion control hangar doors and components indicated in the construction documents are representative of a commercially-available door. Design and fabricate the door to fit within the space allocated and in accordance with the criteria specified herein. Design doors to operate properly without binding, interference, or damage to weather stripping or the adjacent structure. Door must be of limited combustible construction in accordance with [NFPA 220](#) and [NFPA 409](#).

Submit Calculations sealed by the door manufacturer's registered professional engineer for review.

##### 1.6.1.1 Steel Door Components

Design all supporting, steel bracing and framing steel members in accordance with the specified loads and the requirements of [AISC 325](#) and [AISC 360](#). Design all cold formed steel in accordance with [AISI SG03-3](#). Weld steel in accordance with the [AWS D1.1/D1.1M](#) Standards.

#### 1.6.2 Loads

Design the door for the loads in accordance with [UFC 1-200-01](#), [UFC 3-301-01](#) and all other applicable criteria.

##### 1.6.2.1 Wind Loads

In the closed position, design doors and all components to withstand the wind pressures indicated by the Engineer of Record. Design all door components to withstand both the highest positive and negative pressures



based on actual tributary area from the wind load indicated.

In addition, design doors and all components to be operational during wind events which cause a positive or negative service load pressure of 15 psf on the surface of the door.

#### 1.6.3 Deflections

For any door member, the deflection due to design wind load shall not exceed the member's length divided by 120. Design the differential deflection at the door seals to be less than 2 inches.

Design Doors as a system to withstand the upward and downward deflections of the door header structure.

#### 1.6.4 Drive Mechanism

Design the drive mechanism to operate the door against a wind pressure of 5 pounds per square foot perpendicular to the leaf. Design the drive so that when stopped at any point, the door automatically locks in place against a 115 mph wind. Provide sufficient wheel traction to lock hangar doors when the track is wet. Design for the effect door sway and vibration will have on wheel traction in a 115 mph wind.

#### 1.6.5 Door Seals

Use sealing system between door leaf and building, between door leaf and foundation, and between leaf, designed to provide an air tight closure with the building and the ventilation supply air plenum. Coordinate the design of the door seal system with the building architectural and structural details, and the mechanical ventilation systems. Use fully adjustable door seal system to permit initial setting during installation of the doors, and to permit future adjustments. Use door sealing system designed for ease of replacement and that incorporates commercially available components.

#### 1.6.6 Pneumatic Locking Mechanism

Provide manual and pneumatic control devices, piping, tubing and hose for the locking mechanisms. Include the flexible connection to the building air system. Use air system designed to accommodate the non-lubricated building air supply available. Use system designed to maintain air loading of the cylinders at all times except when the lock pins are to be retracted. Locate compressed air accessories, including the filter / regulator assembly, and control valves where they will be readily accessible for maintenance. Secure all tubing runs in the door plenum to the door frame using cushion clamp assemblies spaced to prevent sag in runs. Arrange all tubing runs to prevent accumulated moisture from reaching the air cylinders. Locate air system accessories to be readily accessible for inspection and servicing. Provide manual release of the automatic door in the event of power failure. Accomplish disengagement of the air cylinder by venting the air supply to the cylinder, removing the air loading on the piston. Provide manual retraction of the locking pins by means of a hand pull attachment through a corrosion resistant wire rope cable system.

#### 1.6.7 Electrical Requirements

Use electrical wiring and equipment approved for Class 1, Division 1 locations as described in Article 501 of NFPA 70. Use electric motor (460

V, 3-phase) as prime mover.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Structural Steel

ASTM A36/A36M.

#### 2.1.2 Formed Steel

AISI SG03-3.

#### 2.1.3 Galvanized Steel

Hot dipped galvanized frames in accordance with ASTM A123/A123M.

#### 2.1.4 Sheet Steel

ASTM A1011/A1011M, hot-rolled sheet steel, commercial quality, or ASTM A1008/A1008M, cold-rolled steel sheet, commercial quality.

#### 2.1.5 Galvanized Sheet Steel

ASTM A653/A653M, coating designation G90 galvanized steel sheet, commercial quality.

#### 2.1.6 Exterior Covering

Preform the hanger door/plenums' exterior wall from siding panels over rigid insulation boards, assembled in accordance with the siding manufacturer's standard detail. Provide panels with factory finish equal to Kynar 500 PVDF fluoropolymer

##### 2.1.6.1 Exterior Roof Panels

Coated steel sheets conforming to the requirements of Section 07 41 13 METAL ROOF PANELS, with ribbed exterior face, 1-1/2 inch panel, depth and thickness to meet design loads and purlin spacing, but not less than 22 MFG STD gage, with factory finish equal to Kynar 500 PVDF fluoropolymer.

##### 2.1.6.2 Liner Panels

Coated steel sheets conforming to the requirements of Section 07 41 13 METAL ROOF PANELS, or galvanized steel sheets conforming to ASTM A653/A653M, coating designation G90, with flush interior face, 1-7/8 inch panel depth and thickness to meet design loads and purlin spacing, but not less than 22 MFG STD gage, with factory finish.

##### 2.1.6.3 Insulation

Permanently secure insulation materials in place between the face and line panels. Design the doors to have an air-to-air "U" value not more than 0.05, a flame spread rating of 75 or less and a smoke-developed rating of 100 or less when tested in accordance with ASTM E84. Do not use cellular plastics.

##### 2.1.6.4 Accessories

Sheet metal flashings, trim molding, closure strips, caps, subgirts and other similar sheet metal accessories used in conjunction with the preformed panels shall be of the same material and finish as the panels. Metal shall be of a thickness not less than that used for the panels.

#### 2.1.7 Hardware

Provide hardware suitable for use on hangar doors and designed to accommodate actual dead loads plus wind loads specified herein.

##### 2.1.7.1 Pivots

Provide pivots with heavy duty thrust bearings sealed against dust and water, and with drip-type lubrication fittings requiring infrequent attention. They shall be of sufficient strength to resist all loads specified herein, with a factor of safety of 2. Provide for expansion and contraction over a temperature range of 80 degrees F. Design the top pivot to provide movement in the plane of the door to accommodate a differential settlement of 4 inches within the length of the track and between the track and the building. Design the top pivot to provide movement in the plane of the door in the closed position to accommodate a horizontal displacement of the building of vertical door alignment adjustments at the top and bottom pivot points. The bottom pivot point shall be self-aligning and installed in a cement case with removable weather tight cover, and shall be designed to resist axial and radial thrust loads.

#### 2.1.8 Weatherstripping

Rubber bulb seals shall be resistant to incidental contact with the following chemicals and solvents used in the facility:

MATERIAL	MILITARY OR FEDERAL SPECIFICATION
MEK	ASTM D740
Dope and Lacquer Thinner	CID A-A-857
Aircraft Coating Thinner	MIL-T-81772
High Pressure Cleaning Compound	SAE AMS-C-22542
Ethyl Acetate	ASTM D4614
Non-Ionic Detergent	MIL-D-16791
Conversion Coating	MIL-DTL-5541

#### 2.1.9 Fasteners

Hot dipped galvanized.

#### 2.1.10 Sealant

Single-component or multi-component elastomeric type conforming to ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Provide a sealant that has been tested on the type(s) of substrate to which it will be applied.

## 2.1.11 Light Fixtures

The door manufacturer shall provide all light fixtures indicated in or on the door. Conform to the electrical drawings and the requirements specified in 26 20 00 INTERIOR WIRING SYSTEMS.

## 2.1.12 Personnel Emergency Pass Doors and Plenum Access Doors

Provide doors in each hangar door leaf for personnel access to the building, and for access to the air plenum for maintenance of the drive mechanism and lock pin mechanisms. Doors shall be exterior, hollow metal, flush type, insulated, with gasketed frame to provide an airtight seal. Doors shall conform to 08 11 13 STEEL DOORS AND FRAMES. Provide hardware conforming to 08 71 00 FINISH HARDWARE, as follows:

## a. Personnel Pass Doors:

1-1/2 Pairs, Hinges	A5111 (Temp.) 5 by 4-1/2
1 Each Exit	Type 2, Function 01
1 Each Door Closer	C02061, Size IV
1 Each Kickplate	J102
1 Set Airtight Seals	As specified

## b. Personnel Pass Doors:

1 Pair, Hinges	A5111 (Temp.) 5 by 4-1/2
1 Each Lockset	Series 1000, Grade 1, Function F04
1 Each Door Closer	C02011, Size 111
1 Set Airtight Seals	As specified

## 2.1.13 Concrete and Non-Shrink Grout

Pour in place normal concrete having a strength of 3000 psi. Concrete and non-shrink grout shall conform to the requirements of 03 30 00 CAST-IN-PLACE CONCRETE.

## 2.1.14 Filter Assembly

The filter system for the hangar doors shall consist of a replaceable media filter system in a permanent frame filter bank mounted in the door frame as indicated. The filter frame bank shall consist of universal modular frames, nominal 24 inch by 24 inch, fastened to each other to form an assembly. Fabricate frames from 16 gage galvanized steel and include filter holding clips to permit easy removal of the filters without removal of the clips. Fasten frames to each other and to the supporting door frame by means of stainless steel break mandrel rivets (pop rivets) conforming to MIL-R-24243. Use replaceable filters of the extended surface type, nominal 24 inch by 24 inch by 2 inch deep, with a 30 percent efficiency when rated by ASHRAE 52.2. Filters shall meet the fire-resistant requirements of

UL 900, Class 1. Use pleated type filters with a welded wire media support grid and nonflammable enclosing frame bonded to the filter media. Provide one complete set of replacement filters for each door leaf.

#### 2.1.15 Differential Pressure Switches

Provide each door leaf with a differential pressure switch to annunciate when the filters are dirty and require replacement. Provide 4 inch diaphragm operated differential pressure switches to activate a single pole double throw snap switch. Restrain motion of the diaphragm by a calibrated stainless steel spring adjustable through the full range. Transmit spring range the snap switch by means of a direct mechanical linkage. Switch shall be rated for a temperature range of minus 30 degrees F to 180 degrees F, and a pressure of 10 psig. The operating range shall be 1/2 to 2 inch water column with a maximum dead bank of 0.12 inches water column, and repetitive accuracy of 2 percent of range. Use U.L. listed switch mounted in an explosion-proof housing suitable for use in a Class 1, Division 1, Group D hazardous area. Use 1/8 inch NPT pressure sensing connection. Use 1/2 inch NPT electrical connection. Use switch rated 15 amps, 120 volt A.C., resistive load.

#### 2.1.16 Door Drive Mechanism

Each door leaf shall be driven by a single drive wheel operating on an embedded standard crane rail. The drive wheel shall be driven by an electric worm gear motor through a double reduction chain and sprocket. The drive mechanism shall be capable of operating the door under the design loads specified herein. [ For areas classified as Class 1, Division 1, Group D hazardous areas, all moving parts exposed within the door plenum and the aircraft by shall be non-sparking, except where protected by drive system sealed enclosure. Limit the acceleration of the door to reduce the potential hazard of the drive wheel sparking the rail.] Incorporate machinery in the drive mechanism to permit the door leaf to be operated manually by means of a tractor in the event of a power failure or motor drive failure. The drive mechanism shall be of the design indicated, or shall be of a comparable, previously-proven design for a similar type door which shall be approved by the CQC Representative.

##### 2.1.16.1 Worm Gear Motor

The gear motor shall consist of a multiple reduction helical worm gear reducer with an integrally mated A.C. motor and electric brake.

##### 2.1.16.2 Gear Reducer

The gear reducer shall be A.G.M.A. rated for the design torque with a service factor of 1.0. Use gear reducer housing of high strength cast aluminum or cast steel. The worm shall be machined of high strength leaded alloy steel carburized and hardened to 60-62 Rockwell C, tempered, honed and ground after hardening. The worm gear shall be cast bronze. The output shaft shall be high strength alloy steel. Bearings shall be either tapered or ball rollers on the work shaft and tapered rollers on the output shaft. Use dual lip spring-loaded seals to protect against leakage and foreign matter. Use gear reducer with a large oil reservoir for adequate splash lubrication for cool operation and an easily accessible oil fill, level and drain holes for maintaining proper oil level. The gear reducer shall have an adaptable base, machined for direct mounting to the support structure.

2.1.16.3 Motor

Use integrally mated motor suitable for variable speed operation with input power from an adjustable frequency drive unit, [ explosion-proof for areas designated as Class 1, Division 1, Group D hazardous areas,] [ totally-enclosed, wash-down (TEWD)] constant torque, NEMA Design D, 3 phase, 60 hertz, 460 volt service, with Class B insulation, time and temperature rating 30 minutes 167 degrees F temperature rise over 104 degrees F ambient, 1.2 service factor and with sealed bearings. Include in motor an integrally mounted disc brake in an explosion-proof enclosure. Brake shall have a manual release with automatic reset. Extend shaft through brake for manual operation. Select motor for starting torque and not stall torque. Motor shall conform to NEMA MG 1 standard.

2.1.16.4 Chain and Sprocket Drive

Accomplish double reduction chain and sprocket drive through a sprocket mounted on the output shaft of the gear motor, a sprocket mounted on the drive wheel shaft and an intermediate jack shaft with sprockets. Use single or double strand type sprockets to match the ANSI pitch chain with hardened steel teeth. Use sprockets designed to have a minimum of 40 percent tooth contact. Use jack shaft designed with a clutch mechanism to permit disengaging the gear motor drive from the drive wheel to permit manual operation of the door. Use jackshaft fabricated from high strength alloy steel and supported by two pillow blocks or flanged bearings. Use bearings designed for an L10 life of 20,000 hours, with self-aligning double row spherical bearings in a cast iron housing, a spring locking collar, spring loaded lip seals and grease fittings. Use manual clutch mechanism with a handle of sufficient length to facilitate manual operation and a latching device to assure positive engagement under normal operation when not mechanically retracted for manual operation. Fit the chain and sprocket drive system with an automatic oil lubricator readily accessible for inspection. Use roller chain of single or double strand conforming to ANSI standards for dimensions. Use roller chain of heavy series type rated for occasional shock loading. Use press fit riveted type pins. Use press fit cotter pin type connecting pin.

2.1.16.5 Drive Wheel Truck Assembly

Mount each drive wheel on a removable truck assembly, as indicated, to permit removal and servicing without dismantling the door.

2.1.16.6 Drive Wheel

Use wheel fabricated from heat treated chromium-molybdenum alloy, AISI strength. Use wheels designed to operate on a standard crane rail as specified herein. Use wheels conforming to the following dimensions after machining:

a. Diameter of tread	21.0 inch to 0.005 inch
b. Width of tread	3 1/4 inch
c. Bore	As required

After machining, flame harden wheels to 325 to 375 brinell hardness.

2.1.16.7 Shafting

Fit and weld wheels to a high strength steel tube shaft. Machine tube shaft from hot finished seamless carbon steel mechanical round tubing conforming to [ASTM A519/A519M](#), and steel conforming to [ASTM A1018/A1018M](#) with a wall thickness as required by design. Machine tubing shaft to receive bearings so that the combination with the wheel shall be concentric with the bearings and support shaft within a tolerance of [0.002 inches](#). Run tube shaft on tapered roller bearings press fit into the ends of the tube. Ends of tube are supported by a high strength machined inner shaft mounted directly to the wheel truck. Machine inner shaft from medium carbon, high manganese, free machining, cold finished, Stress proof steel shafting, drawn, ground and polished with a tensile strength of 125,000 psi and a yield strength of 100,000 psi. Drill and tap inner shaft to accommodate lubrication tubing and to permit distribution of grease to both bearings.

#### 2.1.16.8 Tapered Roller Bearings

Use self-aligning, cylindrical bore, spherical roller type bearings, sized for the static and dynamic forces with an LB-10 minimum life rating of 20,000 hours. Use manufacturer's standard precision machined self-locking bearing nut for retaining the bearings on the shaft. Machine bearing sleeve for preloading the tapered roller bearings from Stress proof steel shafting used to support the wheels.

#### 2.1.16.9 Fabricated Truck

Use plate conforming to [ASTM A36/A36M](#) except as indicated and specified herein.

#### 2.1.16.10 Seals and Seal Housing

Fabricate seal housing as indicated for clearance fit to shaft and sleeve. Use double lip, spring loaded seal to retain bearing lubricating grease and protect the bearings from dirt.

#### 2.1.16.11 Bearing Lubrication Components

Use copper tubing the size indicated conforming to [ASTM B88](#), Type L, for use with compression type fittings. Use brass fittings conforming to [SAE J514](#) to connect tubing to shaft and to truck. Use male connector fitting for connection to shaft, male pipe end and flare tube end to receive tubing. Use "Triple-Lok" fittings as manufactured by Parker Hannafin, or approved equal. Provide alemite grease fitting to mate with bulkhead female pipe fitting.

#### 2.1.16.12 Door Drive Mechanism Enclosure

Design and fabricate drive mechanism enclosure to be readily removable to facilitate inspection and maintenance of the mechanical drive components. Fabricate enclosure to airtight to maintain the integrity of the pressurized air plenum.

#### 2.1.17 Lock Pins

Equip leading edge of doors with top and bottom automatic lock pins designed to restrain the door in the full open or full closed positions, under the design operating wind forces. Assure that doors are properly aligned in the fully closed position with seals compressed. Use

non-sparking lock pin mechanisms designed to accommodate thermal expansion and contraction of the doors, with sufficient range of action horizontally to seat under full wind load deflections (inward or outward). Seat bottom lock pins in special receptacles set in the concrete slab designed to accommodate the full travel of the pin, and designed to prevent dirt and water from accumulating inside. Use air operated lock pins designed for normal operating conditions with mechanism to manually release the pins in the event of a failure of the control system. Use lock pin mechanism of the design indicated, or of a comparable, previously proven design for a similar type door approved by the CQC Representative.

#### 2.1.17.1 Operating Mechanism

Use direct action double acting air cylinder operating mechanism for opening and closing the lock pins. Use cylinders sized to operate the lock pins when binding in the receivers under full wind loads or other combination of loads including thermal expansion and contraction of the doors, and settlement deflection of the doors with available 80 psig air. Use cylinder of corrosion-resistant construction suitable for industrial application and rated for 200 psig non-lubricated air service. Machine cylinder barrel head from high strength steel tubing, honed to a 10-15 micron-inch finish and hard chrome plated inside and outside. Fit head with easily externally removable precision machined high strength fine grained iron, bronze or aluminum rod bearing, incorporating seals and rod wiper to prevent dirt from entering cylinder. Use cylinders cushioned at both ends with built-in adjustable needle valves to allow adjustment of the cushion effect. Fit piston with double seals for minimum friction under varying dynamic pressures. Machine cylinder rod from high strength steel, 90,000 to 100,000 psi minimum yield, hard chrome plated, and sized for operating the pin with a factory safety of five based on yield strength. Pre-lubricate cylinder with a permanent type dry lubricant. LR2 Permanently Lubricated Air Cylinders or Universal "A-2" Series Heavy Duty Pre-Lubricated Pneumatic Cylinders as manufactured by Schrader Bellows of Akron, Ohio conform to this specification.

#### 2.1.17.2 Top Pin

Machine top pin cold drawn [ASTM A29/A29M](#), Grade 1018 steel bar stock. Hard chrome plate top pin after machining. Machine pin bottom to mate with the clevis fitting on the air cylinder. Use two sets of bronze guide rollers to guide pin for the full stroke. Use bronze rollers designed to accommodate the maximum forces under the design loadings plus: forces due to temperature expansion and contraction of the door,; forces due to settlement of the door; and other binding forces on the top pin when engaged in its receiver. Use top pin latching receiver assembly designed to accommodate the maximum pin loading and to mate with the [1/2 inch](#) building truss plate provided for the lock mechanism. Use receiver assembly provided with a phosphor bronze liner sheet conforming to [ASTM B103/B103M](#) with a hard temper, minimum tensile strength of 80,000 psi and Rockwell Hardness Number B86.

#### 2.1.17.3 Bottom Pin

Machine bottom pin from cold drawn [ASTM A29/A29M](#), Grade 1018 steel cold finished round stock. Machine pin to thread to the cylinder rod. Guide pins at the bottom of door with UHMW supported in a fabricated steel bracket. Engage pin in sockets embedded on the floor. Use sockets with UHMW sleeves.



## 2.1.17.4 Air System

Use air system for operating the lock pins consisting of shop compressed air available near each door at 1/2 inch valved connection on the aircraft by wall as indicated. The compressed air is classified as industrial plant grade air at a pressure of 100 to 125 psig. The door manufacturer shall provide appropriate air accessories such as valves, regulators, filters, dryers and gages for the operating and control equipment, to ensure trouble-free service.

- a. Air Filter: Each door leaf control air system shall be served by a primary filter separator provided immediately ahead of the pressure regulator. Use filter separator sized for the maximum air flow. Use filter separator capable of separating free water from other liquids, and particulates larger than 5 microns that may cause damage to the pneumatic equipment. Use filter separator with a transparent bowl guard, non-corrosive filter element. Include an automatic drain and replaceable filter elements for filter separator. Provide two spare filter elements for each filter.
- b. Pressure Regulator: Serve each door leaf control air system by a pressure regulator to reduce the 100 to 125 psig plant supply air to 90 psig to provide the regulate air supply for the cylinders. Use relieving regulators with T-bar stem locking handle. Include a pressure gage with a range of 5 to 125 psig.
- c. Air Exhaust Mufflers: Pipe venting and exhaust of control air systems through a muffler to reduce noise level. Use expansion chamber muffler with a built-in resonator and air disseminator. Use muffler constructed entirely of corrosion-resistant metal.
- d. Directional Control Valves: Control operated cylinders by means of a solenoid pilot operated directional control valve suitable for operation in a hazardous location classified as Class 1, Division 1, Group D, approved for rain tightness. Use 2-position, 4-way, single solenoid, pilot actuated, spring return type for solenoid control valve. Use valves rated by manufacturer as suitable for the non-lubricated air service provided. Use internally supplied pilot. Use continuous duty rated solenoid suitable for 115-120 volt A.C. service with Class "A" (221 degrees F) insulation.
- e. Piping System: Use Type K, fully annealed seamless copper tube conforming to ASTM B88 for lock pin pneumatic control piping, including field piping and prefabricated shop assembled components. All fittings employed in the piping system, conforming to SAE J514, except the fitting material shall be brass and bronze compatible with the copper tubing. All factory assembled components shall employ cushion type tubing supports for supporting the tubing runs. Use SAE J1405 air hose rated for 250 psig for flexible hose connection between the building supply and the door. Use hose constructed of a synthetic rubber inner tube, a single partial stainless steel wire braid reinforcement covered by a protective synthetic rubber layer and an outer synthetic rubber impregnated textile cover. Fit hose with brass swivel type reusable fittings.

## 2.1.18 Top Lock Pin Maintenance Platform

Provide a platform, as required, for maintenance of the top lock pin mechanism.

#### 2.1.18.1 Metal Grating

Platform metal grating shall conform to [NAAMM MBG 531](#).

#### 2.1.18.2 Handrails

Fabricate handrails from standard-weight steel pipe, nominal inside diameter [1-1/2 inches](#). Use hot-dipped zinc-coated finished railing assemblies conforming to [ASTM A123/A123M](#). Complete railing with standards, brackets, caps, plugs, toe guards and all other accessories and fastenings for complete job. Fabricate railings in one length for each run and securely anchor to the supporting structure. Conform railing to the requirements of Occupational Safety Health Act Article 1926.500.

#### 2.1.18.3 Jointing

Perform jointing of posts, rail and corners by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints and grinding smooth. Butt railing slices and reinforce with tight fitting interior sleeve not less than [6 inches](#) in length. Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and that the pipe is not crushed. Weld posts welded directly to the steel platform structure.

#### 2.1.18.4 Ladders

Fabricate vertical ladders conforming to [ALI A14.3](#) of [2-1/2 inches](#) by [3/8 inches](#) steel flats for strings and [3/4 inch](#) diameter steel rods for rungs. Space rungs a maximum one foot apart, and plug weld or shoulder and head into strings. Hot dip galvanized ladder assemblies after fabrication in conformance to [ASTM A123/A123M](#). Install ladder so that rungs are not less than [7 inches](#) from the finished wall surface or other structural element. Secure ladder to adjacent construction with heavy clip angles welded to the string and secured to structure as indicated. Install intermediate clip angles not over [48 inches](#) on centers. Install brackets as required for securing to ladders. Provide safety cage and spreaders as required.

#### 2.1.18.5 Safety Chains

Construct safety chains of [3/16 inch](#), zinc-coated, steel welded chain conforming to [FS RR-C-271](#), Type 1, Group C, Class 4 with snap bolt hook with ring on both ends and eye bolt on both ends. Use swivel eye snap bolt hooks conforming to [MIL-DTL-15021](#). Use galvanized eye bolts with [3/8 inch](#) bolt and [3/4 inch](#) eye diameter for attachment of chains. Supply two chains, [4 inches](#) longer than the anchorage spacing, for each guarded area. Mount top chain [3 feet to 6 feet](#) above the platform floor. Mount lower chain [2 feet to zero inches](#) above the platform floor.

#### 2.1.18.6 Structural Framing

Provide additional structural framing welded to the tubular structure to accommodate the platform load.

#### 2.1.19 Electrical Equipment

Provide electric motors, wire and equipment specified under this section conforming to [26 20 00 INTERIOR DISTRIBUTION SYSTEM](#), [NFPA 70](#) and [NEMA ICS 1](#), [NEMA ICS 2](#) and [NEMA ICS 6](#). All electrical wiring entrances and equipment

within the door and mounted on the door within the aircraft bay shall be constructed to NEMA ICS 6 standards [NEMA 250 Type 4/7 for hazardous locations]. Use watertight, NEMA ICS 6, Type 4 enclosures for all electrical wiring and equipment on the exterior of the door.

#### 2.1.19.1 Plenum Lights

Provide fluorescent or LED lights within the door plenum to provide lighting for servicing the drive mechanism and the lock pin mechanisms. Light levels at each maintenance spaces shall be 5 footcandles. Use a switch mounted in the personnel access vestibule adjacent to the plenum access door for light control. Use [ combination explosion-proof and] weatherproof switch for plenum lights. Use 120 volts A.C. obtained from the door drive control transformer as indicated for circuit lighting.

#### 2.1.19.2 Controls

Use two joysticks as part of the controls for each door. Require that operator maintain constant contact with joystick for door drive motor to be engaged or energized. Locate a pushbutton on each side of the door at the "seeing" end with control configuration such that either of the two joysticks can maintain door movement. Locate joysticks such that the operator can "walk" the door to either the open or closed position and have view of the direction of travel while maintaining the hand activation of the joystick. Design door to automatically stop if the operator's hand is removed from the joystick. Include an audible and visual alarm to be activated when the door is in motion. Alarms shall have a distinct warning sound and visual display that is different than all other warning systems in the hangar bay.

Include proximity sensors [ and ] [ or ] switches to detect "near end of travel" and "end of travel" in door and door apron. Include adjustable acceleration and deceleration ramping from zero to maximum speed and from maximum to zero speed in door motor drive. Include an automatic "soft start" with gradual acceleration to a pre-set maximum speed. Include capability to adjust maximum speed. Include automatic deceleration and a gradual stop when a "near end of travel" point is reached. Include automatic disengagement or de-energization when door "end of travel" is reached. Include capability of door motor drive reversing, such that the door can be powered open and powered close.

#### 2.1.19.3 Control Cabinet

House all applicable control components for the door in each control cabinet. Use factory installed and wired control cabinet components for each door. Locate control cabinet on the exterior face of door and size for the electrical control equipment indicated and specified herein. Surface mount cabinet: NEMA ICS 6 Type 4 classification. Fabricate cabinet of 14 gauge steel minimum with all seams continuously welded. Use a 12-gage back panel, for mounting equipment and devices, mounted on collar studs welded to the back face of the enclosure. Use heavy duty continuous hinged door constructed with rolled edge. Attach a neoprene gasket to doors with oil resistant adhesive and steel retaining strips. Provide stainless steel door clamps to hold the door securely closed. Punch holes in door to accept control switches and indicator lights as indicated. Include an exterior flange mounted NEMA ICS 6 Type 4 disconnect switch. Interlock the padlockable operating switch handle with the cabinet door so that the door can only be opened when the disconnect switch is open. Size the switch based on the voltage and electrical load in accordance with

**NFPA 70.** Cabinets shall contain the following equipment.

- a. A microprocessor-based adjustable frequency motor drive unit (for each door) such that the door drive motor (460 volt, 3 phase) shall have variable speed capability. Make drive until capable of reversing. Motor protection in compliance with **NFPA 70**, Article 430. Make drive until capable of producing a controlled adjustable frequency/voltage output at suitable power levels to successfully operate the door drive mechanism.

Use UL listed adjustable frequency drive unit in compliance with **IEEE 519**. Use additional supplemental equipment as necessary to comply with **IEEE 519**. Submit a mathematical analysis by the drive until vendor verifying compliance.

The adjustable frequency drive units shall have as a minimum the following features:

- (1) Ambient operating temperature range:
    - (a) 32 to 104 degrees F.
    - (b) Humidity 5-95", non-condensing.
  - (2) Electrical:
    - (a) Input Voltage: 460 VAC < plus 10 percent, minus 5 percent. 3-phase.
    - (b) Input Frequency: 58-62 Hz.
    - (c) Output Voltage: 0-460 VAC, 3-phase.
    - (d) Output Frequency: 3 -60 Hz. The output shall be as a result of a sine coded pulse width modulated (PEM) output from the inverter section. Frequency regulation shall be plus 0.5 percent of maximum.
    - (e) Current ratings: continuous for 100 percent of drive rating, 120 percent for one minute.
    - (f) Electronic circuitry protection.
    - (g) Minimum .94 power factor.
  - (3) Programmable functions:
    - (a) Acceleration rate.
    - (b) Deceleration rate.
    - (c) Voltage boost.
    - (d) Maximum frequency.
    - (e) Output current limit.
    - (f) Motor overload.
    - (g) Reduced volts per Hertz.
  - (4) LED or digital display of the following:
    - (a) Overvoltage.
    - (b) Undervoltage.
    - (c) Ground fault..
    - (d) Instantaneous current
    - (e) Overtemperature.
- b. Use control transformers rated 2 KVA 480-120 volts, 60 Hz.
  - c. Use door mounted indicator lights, **NEMA ICS 6**, Type 4 transformer style, push-to-test type for operation up to 120 volts AC/DC. Use colored lens as indicated. Square D Type SK control units conform to this specification.

- d. Door mount push-button switches, NEMA ICS 6, Type 4, 4X momentary contact type for operation on 120 volts AC. Use black buttons, except use red for "off" and "open" buttons. Include extended guards for pushbuttons to protect against accidental operation.
- e. Use control relays rated at not less than 250 V, 60 Hz, 10 A contacts, 120 V, 60 Hz coils. Use plug in type, suitable for mounting to the back panel of the control cabinet with clamp type terminals. Furnish a minimum of one spare contact per relay. Use break coil relays rated for 600 V.
- f. Use programmable logic controller (PLC) to perform all control and timing of door operation. I/O no greater than 1200 AC or DC. Use relay suitable for mounting to the back panel.
- [ g. Use Factory Mutual approved intrinsically safe barrier relays for hazard classification Class 1, Division 1, Group D. Suitable for use with a "close" pushbutton. Capable of switching a 120 V, 60 Hz, 5A load and withstanding 20 A inrush in one second. Use encapsulated, irreparable, and vibration resistant relay.
- ] h. Use solid-state pulsating type piezoelectric horns suitable for use at 120 V, 60 Hz. Produce a one-half second intermittent 3900 Hz tone of approximately 50 percent duty cycle. Minimum sound level 85 dB at 2 feet on axis. Suitable for door mounting with screw type terminals.
- i. Use barrier type terminal blocks made of thermosetting phenolic or nylon rated for 600 V, 20A with a maximum operating temperature of 250 degrees F. Use tabular screw blocks with pressure plate terminals. Locate marking strips on the top of the terminal block and center between the binding screws to permit full access to the binding screws with the marking strip in place.
- j. Use 120 V fuses, 1-1/4 inch, quick blow cartridge type in suitable fuse block for back panel mounting. Capable of handling 20 A continuous with screw or clamp type terminals.
- k. Fabricate nameplates from plastic laminate 3-ply engraving stock, minimum thickness 1/32 inch, dark blue with white core. Characters a minimum of 1/8 inch high, all capitals, gothic, unless noted otherwise. Engrave information; locate as indicated. Unless noted otherwise, determine nameplate length and height to fit legend and to present a neat and pleasing appearance. Engrave legend plates at pushbuttons and indicator lights engraved as indicated.
- l. Provide cooling fans if necessary for proper cooling of cabinet components.

#### 2.1.19.4 Joysticks

On the control cabinet door and the interior face of the door, use bidirectional spring-return-to-center type joysticks with normally open contacts as indicated. Handle 3-3/4 inches long, threaded to accept a spherical phenolic knob. Comply with NEMA ICS 4, suitable for 120 volts 60 hertz operation. Install joystick on the interior face of the door in a NEMA ICS 6 Type 4 enclosure. As of publication, Cutler Hammer File E20 two position joysticks conform to this specification.

#### 2.1.19.5 Limit Switches

Use heavy duty type limit switches, mechanically actuated, [ in a NEMA ICS 6 Type 4, 7 explosion proof weathertight enclosure] [in a NEMA ICS 6 Type 4 weathertight enclosure]. Use contacts rated 10 amperes, 600 volts, DPDT. Use limit operable in ambient temperatures from minus 10 to 185 degrees F. Microswitch Type LCS and HDLS limit switches conform to this specification.

#### 2.1.19.6 Klaxon Horns

Use weatherproof, A.C. vibration type horns for annunciation of door movement suitable for operation on 120 volts 60 hertz. Use horns with adjustable volume, range of 78 to 128 db SPL measured on axis at 10 feet.

#### 2.1.19.7 Explosion Proof Control Devices

On the door interior face use weathertight and explosion proof indicator lights and pushbutton (Class 1, Division 1, Group D, hazardous area), suitable for use in 120 volt 60 hertz control circuit. Use NEMA ICS 6, Type 4, 7 enclosures as indicated.

#### 2.1.19.8 Interconnecting Cable

Between each door and building interface junction box, use cable Type SO, UL listed, neoprene jacketed, 600 volt rated, of the number of conduits and gage indicated. Use cable consisting of multiple stranded bare copper conductors, with a flexible heavy duty black neoprene jacket overall suitable for exterior installation to resist ozone, sunlight, moisture, oil and abrasion. Supply cable of sufficient length to accommodate the door swing.

#### 2.1.19.9 Conduit, Wire and Fittings

- a. Conduit: rigid hot dipped galvanized steel with thread connections.
- b. Within the control cabinet, use stranded copper wire type SIS. Minimum size power wiring: No.12 AWG. Minimum size control wiring: No.14 AWG. In conduit, use stranded copper wire Type THWN No.14 for control and No.12 for Power.
- [ c. Within the door and on the interior wall use explosion proof and weathertight boxes and fittings, NEMA ICS 6 Type 4, 7.
- d. Use conduit seals suitable for Class 1, Division 1, Group D hazardous area.
- ] e. Use watertight fittings for Type SO cable.
- [ f. In hazardous areas use flexible conduit suitable for installation in a Class 1, Division 1, Group D hazardous area.

#### ]2.1.19.10 Rotating Beacons

Use rotating beacons rated 120 volts or 360 degree rotation, weatherproof, red dome, gasketed aluminum shock mount housing, suitable for 1 inch stanchion mounting.

### 2.2 FABRICATION

#### 2.2.1 Doors

Use door leaves fabricated from hot rolled sections or structural tubing in accordance with [AISC 325](#) and [AWS D1.1/D1.1M](#). Welded joints except where impractical. All joints shall develop 100 percent of the strength of the framing members. [ Prepare splices accurately to facilitate field assembly in accordance with standard practice.] Use frames and framing members true to dimensions and square in all directions; no leaf shall be bowed, warped or out of line in the vertical or horizontal plane of the door opening by more than [1/8 inch in 20 feet](#). Provide bracing so that the completed leaf assembly will be adequately braced to withstand shipping, assembly and operational loads. Ground smooth exposed welds and welds which interfere with the installation of parts such as wall panels and cove sheets. Seal flat cover sheets with sealant and fasten to frame either by edge welding, plug welding or threaded fasteners on [12 inch](#) centers. Prepare, prime, and coat structural framing and miscellaneous steel as specified in paragraph FINISHES. Seal joints in assembled door/plenum to provide an airtight plenum.

#### 2.2.2 Latches

Provide automatic latching devices at top and bottom of doors to take over positioning of the doors during closing, compress the seals, and anchor the door against full wind and seismic loads. Use devices with sufficient throw to allow for thermal expansion and contraction of the doors, and sufficient range of action horizontally to set under full wind deflection, inward or outward. Provide an automatic foot bolt to anchor the door in fully open position. seat bottom bolts in dust-proof strikes set in concrete pavement. Interlock latching devices with motors to prevent door operation unless the bolts are fully retracted.

#### 2.2.3 Tractor Pulls

Provide tractor pulls so that leaves can be towed by a tractor or similar equipment. The tractor pull shall be designed for a drive force to tow door of [5000 pounds](#) whichever is greater. Minimum thickness steel plate shall [3/8 inch](#).

#### 2.2.4 Exterior Covering

Install exterior covering on the assembled door structure in accordance with the siding manufacturer's recommendation and approved shop drawings. Form and seal joints so that both sides of the covering are weathertight and the plenum is airtight.

#### 2.2.5 Interior Covering

Fabricate interior wall of hangar door/plenums of aluminum sheet, perforated in a regular pattern with holes [1/2 inch](#) diameter providing the total free area per door leaf indicated. Use sheet sufficiently thick to meet design loads and purlin spacing. Install sheets with the smooth side of punched holes on the exterior face of the door. Fasten sheets in place to vertical and horizontal framing members at [12 inches](#) on center maximum with No. 14 or larger, self-tapping screws. Seal joints to provide an airtight plenum.

#### 2.2.6 Weatherstripping

Install resilient bulb seals as [ shown ] [ required ], to provide a weathertight seal around the perimeter of the door leaves and an airtight

seal at the perimeter of the plenum opening mating surfaces with the supply ducts at the door head. Provide seals with molded or vulcanized corners. Reinforce bottom seals with woven fabric. Install seals designed to allow for horizontal displacement of the building at the head of the door plus or minus 3 inches in the plane of the door in the closed position under seismic loading.

#### 2.2.7 Support Rail

Use support rail as indicated per civil drawings to support wheel loads. Furnish complete with anchor bolts and leveling plates as indicated, installed by the door manufacturer. Set the rails to the indicated radius, plus or minus 1/8 inch and leveled to within plus or minus 0.1 inch to 10 feet. From side to side, the top of the rail shall not vary more than 2 degrees from true level.

#### 2.2.8 Services

The door manufacturer shall provide all piping, wiring and devices in the door.

#### 2.2.9 Perforated Aluminum

Attach the aluminum perforated sheets to the door frame with plated fasteners with neoprene washers at not more than 12 inches on centers. Protect dissimilar metals with bituminous paint. The thickness of the sheet .10 5052 alloy H32 hardness. Holes shall be [\_\_\_\_\_] inch at 1 inch on centers. 8 percent open.

#### 2.2.10 Electrical

All manual and automatic control devices, control cabinets, light fixtures, door mounted interface junction boxes with cable and all conduit and wiring mounted on the doors and specified herein shall be provided under this section. Raceways and interconnect wiring within the aircraft bays will be provided under 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Use color coded wiring, clearly labeled with identification numbers in accordance with approved shop drawings. Make individual wire identification at all terminations with wire numbers stamped on durable plastic heat-shrinkable sleeving, 3/4 inch minimum length. Neatly train and lace wiring within the cabinet or run in plastic wiring ducts. Make cable connections to boxes watertight cable clamps. Make conduit connections to motor and limit switches with flexible conduit [explosion proof in Class 1, Division 1, Group D hazardous areas] or liquid tight flexible conduit to permit servicing of equipment and of sufficient length to permit field adjustment. Secure conduit to the door structure. [ Provide conduits entering hazardous areas and areas with arcing devices with conduit seals in accordance with NFPA 70.] Install conduit runs to permit easy access to junction boxes and not to interfere with the operation of the door or with servicing of components. Electrical installation shall conform to the requirements of 26 20 00 INTERIOR WIRING SYSTEMS, and NEMA ICS 1.

### 2.3 FINISHES

#### 2.3.1 Ferrous Metal

Clean, prepare, and coat all exposed and non-exposed ferrous metal surfaces as part of the Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES work, including all requirements, submittals, certifications,



testing, and inspections required by Section 09 97 13.27. Do not coat finished bearing surfaces. Alternate coating systems or products will not be considered. Prepare surface and apply coatings in the shop, following all temperature, humidity, and testing requirements listed in the Section 09 97 13.27. After installation of the door, prep and touch up surfaces damaged during assembly and installation of the door. Prep and coat unfinished ferrous metal accessories such as bolts and brackets.

### 2.3.2 Factory-Finished Panels

All factory-finished ferrous metal panels to be exposed to the interior or exterior shall be galvanized G90 per ASTM A653/A653M and coated with a PVDF fluoropolymer equal to Kynar 500.

### 2.4 SINAGE

Provide a placard sign immediately adjacent to the controls explaining how to operate the door and indicating the following:

#### a. Notice

- (1) Doors must be closed and not operated when wind speeds above 60 mph are expected.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

The installation of the assemblies shall be performed by workmen skilled in this type of work in accordance with the approved shop erection drawings and procedures. Use erecting equipment suitable for the work and in fully operable condition. Report immediately to the CQC Representative if parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation. Obtain approval of the method of correction from the CQC Representative, and make correction in his presence. Use approved methods to straighten plates, angles or other structural shapes.

### 3.2 ERECTION

Assemble doors and accessories in accordance with approved shop drawings. Do not erect doors until the work of other trades in preparing the opening has been completed and the hangar roof is completed and under full dead load.

#### 3.2.1 Erection Procedure

Include in the erection procedure complete description of the material handling equipment and accessories and the methods which will be used to assure that individual assemblies will not twist, buckle, deform or otherwise be damaged during the handling and erection. Describe the method of alignment and leveling of the rails including equipment to be used. Describe the method of alignment of the door structure with respect to the pivots, locks and seals of the building.

##### 3.2.1.1 Templates

Furnish steel templates and installation instructions, including placing drawings, for setting the anchor bolts for the door rail and embedded lock

pin receptacles. The manufacture of the door shall ascertain that these items are properly set prior to the installation of the rails and the erection of the doors.

#### 3.2.1.2 Door Rails

Anchor door rails to the concrete support base as indicated using the double nut method on anchor bolts for adjusting and setting elevation. Weld all rail joints and grind smooth. Set rails to indicated radius within a tolerance of plus or minus  $1/32$  inch. Place non-shrink grout to provide continuous positive contact with the underside of the rails. After the non-shrink grout has cured, and after the rail grounds provided under 26 20 00 INTERIOR WIRING SYSTEMS are installed, and after door and drive assemblies have been checked for alignment and fit, fill the remainder of rail recess in the concrete base with concrete. Conform to 03 30 00 CAST-IN-PLACE CONCRETE.

#### 3.2.1.3 Door Bottom Lock Pin Receivers

Locate lock pin receiver assemblies accurately and set to elevation indicated plus or minus  $1/32$  inch using the double nut method on the anchor bolts. Protect spring assembly during placement of concrete to prevent damage or entry of foreign matter.

#### 3.2.1.4 Door Leafs

Field erect door leafs in accordance with approved shop erection drawings after: the rails have been installed and checked for alignment and grade; the bottom pivot base assembly has been installed and checked for alignment and grade; and the lock pin receiver assemblies have been installed and checked for location and grade. First install lower assembly of each door leaf on the bottom pivot with the drive wheel on the rail. After checking for fit, erect and mate the upper assemblies to the lower assembly and the top pivot. Before installing the siding, concrete base fill, filter bank and seals, manually operate each door leaf through the total of 90 degrees of travel to check for final alignment, fit and freedom of movement of the pivots with no binding. After confirmation of the proper movement of each door leaf, permanently locate all limit switches and secure. Place concrete fill, followed by the siding, flashing and seals. Make all electrical and compressed air connections with the building services. Commission and test the drive mechanism and lock pin mechanisms. Perform installation to assure that the equipment will function properly for its intended purpose in conformance with the requirements of the drawings and specifications. After installation has been completed, the Contractor shall perform such final adjustments, operational testing, and cleaning to assure conformance with the requirements specified herein.

#### 3.2.1.5 Compressed Air Tubing

Run tubing in maximum lengths possible without breaks or fittings. Install tubing runs and bends free of kinks, ripples or flattened surfaces. Align tubing with connectors before connections are made. Make appropriate union fittings for tubing connections to accessories and devices to permit removal of the item without removal of the tubing. Before final connection to the air system accessories and cylinders, clean and pressure test entire air piping system leaks in accordance with section 43 15 00.00 20 LOW PRESSURE COMPRESSED AIR PIPING (NON-BREATHING AIR TYPE).

#### 3.2.1.6 Electrical

Install and wire electrical power and control systems, including the motion annunciators (horn and light), and limit switches. Adjust location of each limit switch and set in proper position. [ The electrical installation within the doors and on the interior faces of the doors for Class 1, Division 1, Group D hazardous areas shall conform to NFPA 70 requirements.] Make watertight installation of electrical on the outside of doors. Make the SO power and control cables between the building interface junction boxes and the door of sufficient length to permit full travel of the doors without tangling or binding. Wire exit light as indicated. All wiring within the building including the interface junction boxes on the building will be performed under 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### 3.2.1.7 Touch-Up Coating

After installation of the door, the same installer that performed the initial coating prior to assembly and erection shall prep and touch up surfaces damaged during assembly and installation of the door as well as unfinished ferrous metal accessories per the requirements listed in Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES and per this Section.

### 3.3 FIELD INSPECTION AND TESTS

The Contractor Quality Control Representative shall perform all field inspections and tests specified herein at the Contractor's expense.

#### 3.3.1 Inspection General

Inspection shall continue during receipt and off-loading of door components and during erection. Make an inspection of the fabricated components prior to installation to determine conformance with the specifications and approved shop drawings. Correct or replace all rejected material to the satisfaction of the CQC Representative.

#### 3.3.2 Manufacturer's Field Engineer

The manufacturer of the hangar doors shall provide a qualified field engineer to supervise the installation and perform the inspection services specified hereinafter. The field engineer shall furnish duplicate copies of his report to the Contractor Quality Control Representative within 24 hours following each inspection. The Contractor shall furnish a copy of the field inspection engineer's report to the CQC Representative within 48 hours and shall perform the following:

- a. Inspect doors during job site unloading, sub-assembly and prior to erection.
- b. Inspect installation of rails and other embedded items before pouring of fill concrete to ensure that the elevation and alignment indicated have been complied with and that rails are level to the specified tolerance.
- c. Recheck rails and other embedded items to verify the accuracy of dimensions.
- d. Provide recommendations for any necessary corrective action.

- e. Inspect final erection and assembly of door leafs for alignment and fit, and clearance between doors and building, and between door and leafs.
- f. Inspect setting of all seals in the closed position to assure an airtight installation.
- g. Inspect the positioning and fit of pivot assemblies.
- h. Inspect the mating of lock pins with receptacles.
- i. Inspect all fasteners to assure that all screws and bolts are properly secured to prevent loosening.
- j. Inspect all field welds in accordance with AWS D1.1/D1.1M.
- k. Check all drive assemblies and lock pins for smooth operation and that all lubrication has been accomplished.
- l. Check that final sealing provides an airtight plenum.
- m. Verify that all gear boxes and bearings have been lubricated.
- n. Supervise the testing, including the balancing of the air flow specified herein.

### 3.3.3 Operation

Install doors for smooth operation, providing indicated clearance and seal with the building. Door shall not bind or damage sealing mechanism while being opened or closed. Door shall be free of twists.

### 3.3.4 Tests

Upon completion of the installation, subject doors to operational tests. When all necessary corrections have been accomplished, advise the CQC Representative. CQC Representative will schedule a final inspection and test. Furnish all instruments, labor and materials required for test. The Manufacturer's field engineer shall be present to conduct the test. Test each door leaf for the full extent of its travel in both directions and check to assure that there is no conflict when both leafs are operated simultaneously. Power operate each door leaf through twenty cycles to measure travel time. Test doors to demonstrate manual opening and closing, and unlocking without electric power. Demonstrate the distribution of the ventilation supply air through the diffuse and filter assemblies for uniformity of velocity.

### 3.3.5 Corrections

Adjust doors failing to operate properly.

## 3.4 PERSONNEL EQUIPMENT SYSTEMS ORIENTATION

Provide orientation and instruction of Government plant personnel in the operation and maintenance of the doors, mechanical drive system, locking systems and pivot system. Provide a factory trained representative to conduct formal classes at the facility for one eight-hour period during the final check-out and acceptance stages for the entire door system, after the receipt by the Government of approved operation and maintenance manuals.

-- End of Section --

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## SECTION 08 34 58

## FILE ROOM DOORS AND FRAMES

08/08

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## UNDERWRITERS LABORATORIES (UL)

- UL 140 (2006; Reprint Aug 2012) Relocking Devices for Safes and Vaults
- UL 155 (2000; Reprint Aug 2013) Standard Tests for Fire Resistance of Vault and File Room Doors
- UL 768 (2006; Reprint Jul 2013) Standard for Combination Locks

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Vault Door Unit

Doors

Day Gate

Frames and Sills

Hardware

## SD-03 Product Data

Vault Door Unit

Doors

Day Gate

Frames and Sills

## SD-07 Certificates

## Vault Door Unit

## Frames and Sills

## Hardware

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store and handle doors and frames in a manner that prevents damage.

## PART 2 PRODUCTS

## 2.1 VAULT DOOR UNIT

Provide an insulated, steel, flat-sill, record-vault-type door with frame that is a standard product of a manufacturer specializing in this type of construction.

## 2.2 DOORS

Design and construction of doors must be manufacturer's standard with a **UL 155** fire-resistant classification for a [6-hour] [4-hour] [2-hour] exposure rating, bearing the UL label on the door and frame for the exposure rating required. Provide doors of the size indicated. The finish for door, frame, and hardware must be the manufacturer's standard for the type door indicated. Provide each door equipped with a relocking device conforming to **UL 140** and with an inner escape device that permits the bolt work to be released from inside the vault. [Escape mechanism to be panic bar type or other approved type requiring no tools or special instructions for operation.] [Provide printed instructions for operating the escape device inside the vault near the escape device release.] Provide **Hardware** meeting the following specifications:

- a. Provide [not less than 5 bolts for the door] [five bolts for each side of the door]. Each bolt must be greater than **11/16 inch** in diameter and permanently lubricated. When the bolts are not located on both jamb sides of the door, the jamb side not provided with bolts must interlock with the frame walls of that side. Exposed bolt work must be corrosion resistant or nickel plated steel.
- b. Provide each door with not less than three heavy, offset roller or ball bearing steel hinges, unless noted otherwise on the drawings.
- c. Provide a combination lock that complies with **UL 768**, Group 1R, for each door. Provide locking mechanism operated by means of a lever handle. Provide locks that are combination 3 or 4 tumbler, key or hand-changing type with metal cases protected by drill-resistive steel plates and operated by lever handles. The front-plate of the doors must be not lighter than **0.060 inch** steel plate either riveted or welded to the edge plates. Edge plates and back plates of doors must be not lighter than **0.032 inch** steel. Lock must be [highly resistant to expert manipulation conforming to **UL 768**, Group I, combination locks.] [reasonably resistant to unauthorized opening conforming to Group II of **UL 768** combination locks.]
- d. Submit installation drawings which include details of construction, method of anchorage and type and location of the following: Vault Door Units, Hardware, Frames and Sills, and Day Gate



- e. The label or listing of the Underwriters Laboratories, for fire-resistance classification and safety-relocking devices is acceptable as sufficient evidence that the vault-door unit conforms to these requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency adequately equipped and competent to perform such services, stating that the vault-door unit has been tested and that this unit conforms to the requirements listed herein, including methods of testing of the Underwriters Laboratories, Inc.
- f. Submit certificates attesting that the vault-door unit, frames, sills, and hardware furnished under this specification conform with the referenced standards contained in this section and to the requirements of the Underwriters Laboratories.

### 2.3 Frames and Sills

Provide frames of the tongue-and-groove interlocking type, constructed of not lighter than 0.0478 inch cold-formed steel, formed from a single length for each jamb and a single length for the head. Continuously weld head and jambs along the entire intersection. Sills must be flat and not less in width than the jambs. Provide frame, jambs and heads insulated with the same material as the door. Design the frame for the thickness of vault wall indicated. Submit Manufacturer's descriptive data and catalog cuts and preprinted installation instructions.

### 2.4 Day Gate

The vault door unit must include a day gate of the manufacturer's standard make, and the door frame designed to accommodate this day gate. The gate must be of the swing-in, hinged type, with not less than 5/8 inch diameter rods, and the gate frame of not less than 3/8 inch by 1-1/4 inch aluminum or steel members. Provide the day gate equipped with a locking device arranged to permit locking and unlocking of the gate [from the inside only]. Finish of the day gate must be the manufacturer's standard. The day gate must not interfere with the operation of the inner escape device.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install the vault door unit in strict compliance with the approved installation instructions and drawings provided by the manufacturer. [Install the day gate in a manner that does not interfere with operation of the release handle on the inside of the vault door.] After installation, adjust the door, the locking mechanism, and the inner escape for proper operation.

-- End of Section --

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## SECTION 08 34 59

## VAULT DOORS AND DAY GATES

08/08, CHG 1: 11/12

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-D-600 (Rev D, Am 1; Am 4) Door, Vault, Security

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)

## 1.2 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for project LEED BD+C [local/regional materials] [ and ] [recycled content] and LEED documentation requirements.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Vault Door Unit; G[, [\_\_\_\_]]  
Day Gate; G[, [\_\_\_\_]]

## SD-03 Product Data

Vault Door and Frame

## SD-07 Certificates

Vault Door and Frame

## SD-08 Manufacturer's Instructions

Installation

## SD-11 Closeout Submittals

## LEED Documentation

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver door and frame assemblies to the jobsite in a protective covering with the brand and name clearly marked thereon. Inspect materials delivered to the jobsite for damage, and unload them with a minimum of handling. Store in a dry location with adequate ventilation, free from dust, water, and other contaminants, and allowing easy access for inspection and handling. Store door assemblies off the floor on nonabsorptive strips or wood platforms. Prevent damage to doors and frames during handling. Replace damaged items that cannot be restored to like-new condition.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide **vault door unit** consisting of a steel security-vault type door with frame, [day gate], and ramp type threshold, which is a standard product of a manufacturer specializing in this type of fabrication. Submit drawings showing head, jamb, and sill sections, and elevations of the doors [and gate].

### 2.2 VAULT DOOR AND FRAME

Design and construct the door and frame assembly in conformance with **FS AA-D-600**. Provide a door which is Class [5-V] [5-A] [5-B], Type [IR - right opening swing with optical device] [IL - left opening swing with optical device] [IIR - right opening swing without optical device] [IIL - left opening swing without optical device] [IIIR - double leaf, active right opening swing] [IIIL - double leaf, active left opening swing], Style [H - hand change combination lock] [K - key change combination lock], Design [S - single lock] [B - no exterior hardware]. [The optical device must permit observation from the [inside to the outside] [outside to the inside] of the vault.] Submit manufacturer's catalog data including catalog cuts and brochures showing that the proposed vault door unit conforms with the requirements in **FS AA-D-600**, and has been tested and approved by the General Services Administration (GSA). Submit certification stating that the vault-door units that do not bear the GSA label are constructed to Class [5-V] [5-A] [5-B] standards.

### 2.3 DAY GATE

Provide a day gate which is the manufacturer's [standard] [custom] product designed for use with the vault door furnished, and that provides access control [and visual security] [and [material] [equipment] [weapons] issue]. The gate must be hinged on the same side as the vault door, swing into the vault, and have a locking device operable from outside by key and from inside by knob or handle. [Include an issue port hatch [and [12] [\_\_\_\_\_] gage thick steel shelf]. The issue port must be a framed 8 by 12 inch opening with a minimum [22] [\_\_\_\_\_] gage thick steel protective door (hatch cover) which is hinged and lockable from the interior side. Weld the issue port frame to the day gate. [The shelf must be [12] [\_\_\_\_\_] inches deep by width to match the port hatch.]] Provide the manufacturer's standard finish. The day gate must not interfere with the operation of vault door inner escape device.

## PART 3 EXECUTION

## 3.1 INSTALLATION

Install the vault door assembly in strict compliance with the printed instructions and drawings provided by the manufacturer. Install the day gate in a manner that does not interfere with operation of the release handle on the inside of the vault door. After installation, adjust the door, the locking mechanism, and the inner escape device for proper operation. Submit printed instructions and drawings provided by the manufacturer.

-- End of Section --

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## SECTION 08 34 63

## DETENTION HOLLOW METAL FRAMES, DOORS, AND DOOR FRAMES

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM G60	(2001; R 2018) Standard Practice for Conducting Cyclic Humidity Exposures

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 863	(2014) Guide Specifications for Detention Security Hollow Metal Doors and Frames
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-02 Shop Drawings**

Detention hollow metal **doors and frames**

Submit details at not less than 1/4 full size for each frame type, and elevations of door design type at 3/8 inch equals one foot minimum, show conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Indicate

fabrication, erection, anchorage, and accessory items.

Submit a schedule listing the location of each door and frame using indicated reference numbers for details and openings shown.

#### SD-03 Product Data

Detention hollow metal [doors and frames](#)

Submit manufacturer's material and fabrication specifications.

#### SD-06 Test Reports

[Door fabrication](#)

Prior to fabrication, submit test report for reinforced flush door of the type to be provided on this project.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver hollow metal work with packaging to provide protection during transit and job storage as recommended by the manufacturer. Door frames shall be provided with steel spreader angles, temporarily attached to the bottom of both jambs, one on each side of the opening to serve as a brace during shipping and handling. Inspect hollow metal work upon delivery for damage. Store hollow metal units on raised platforms in vertical positions with blocking between units to allow air circulation. Keep stored material covered and protected from damage and rust. Do not cover with plastic or unvented canvas.

### 1.4 HARDWARE COORDINATION CONFERENCE

Conduct a conference for hardware and hollow metal work prior to submittals for the purpose of coordinating the interface of materials that are furnished by the participants listed. Require that a representative of the entity responsible for each of the following functions attend the conference. Notify the following participants a minimum of 5 working days before the conference:

- a. Contractor
- b. Hollow metal supplier and installer
- c. Detention hollow metal supplier and installer
- d. Hardware supplier
- e. Hardware installer
- f. Detention hardware supplier
- g. Detention hardware installer
- h. Remote control operator and locking device supplier and installer
- i. Electrical contractor.

## PART 2 PRODUCTS



## 2.1 MATERIALS

### 2.1.1 Hot-Rolled Carbon Steel

ASTM A1011/A1011M, commercial quality, 14 gage and thicker.

### 2.1.2 Cold-Rolled Carbon Steel

ASTM A1008/A1008M, commercial quality, stretcher level sheets, 12 gage.

### 2.1.3 Galvanized Steel

ASTM A653/A653M, CQ, mill phosphatized tested by ASTM G60.

## 2.2 DETENTION HOLLOW METAL DOORS AND FRAMES

### 2.2.1 Door Fabrication

- a. Provide doors fabricated of cold rolled, pickled and oiled stretcher leveled steel sheets with clean smooth surfaces. Gages shall be as indicated for each type of door. Form molded members straight with joints coped or mitered, and in true alignment. Welded joints on exposed surfaces shall be dressed smooth, to be invisible. Doors shall be custom made full flush design, internally reinforced, sound deadened and insulated, 2 inches thick to receive detention locks, of the elevations, types and sizes shown on the approved shop drawings and schedules.
- b. Face sheets shall be mild steel fully welded on edges with continuous inner-reinforcements full height and width. Provide internally 10 gage steel channel banding around complete door perimeter, spot welded to face sheet 3 inches on center. Inner reinforcements shall be truss design with triangular form, or interlocking channels with "Z" bar stiffeners, the shape of which cannot be altered without changing the length of the sides. Flat apexes shall be resistance spot welded on 2 3/4 inches centers horizontally and 3 inches centers vertically. Insulate each flute of reinforcement with 6 pound density rock wool.
- c. Bevel vertical door edges 1/8 inch in 2 inches and internally reinforced full length with 1/8 inch thick steel channels spot welded not over 3 inches on center inside both door faces. Close top and bottom door edges with continuous recessed 10 gage channels extending the full width of the door and welded 3 inches on center maximum to both faces and continuously welded to the vertical door edge channels to form a single perimeter frame inside the door. Top and bottom edges of doors shall be finished flush, except for provisions for weatherproofing. Mortise, reinforce, drill and tap door edges to receive templated specified hardware in accordance with the approved hardware schedule and the hardware manufacturer's recommendations for the proper installation of hardware and detention equipment.
- d. Clearances shall be coordinated with frame and in accordance with NAAMM HMMA 863, Part 2, Section 2.02.
- e. Doors shall be free from warpage, wind or buckle. Bends shall be of minimum radius for the gage of metal used.
- f. The removable glass stop shall consist of 10 gage angle securely fastened to the frame using machine screws ( 1/4 inch #20UNRC: one

inch at 6 inches on center and no more than 4 inches from corners). Exposed screw heads shall be button head type, and shall be torx fitting tamperproof. The finished glass stop shall be tight fitting and mitered at the corner joints. There shall be a minimum one inch glass engagement.

#### 2.2.2 Door and View Window Frame Fabrication

- a. Custom-made, fully assembled, factory-welded units of the size and shapes shown on the approved shop drawings. "Knock-down" frames will not be accepted. Coordinate frame dimension to thickness of door or glass.
- b. Strong, rigid, neat in appearance, and free from defects. Frame members shall be clean cut, straight, and of uniform profile.
- c. Form frames to provide mitered trim and butted stops. Join head and jamb members by continuous welds occupying the full depth and width of the frame. Grind exposed welds smooth and flush.
- d. When frames are for door light or food pass, fabricate members as closed tubular shapes having no visible seams or joints on exposed surfaces. Grind exposed welds smooth and flush.
- e. Frames over 4 feet wide installed in masonry partitions shall have a channel stiffener not less than 13 gage welded into the head at the factory.
- f. Protect cutouts and reinforcements with pressed steel mortar guards on the inside of the frame.
- g. Floor anchors formed of not less than 12 gage steel shall be securely welded to the bottom of each jamb. [Where scheduled, adjustable floor anchors extending not less than 2 inches below the finish floor line shall be provided.]
- h. Frames for installation in masonry walls shall be provided with non-removable adjustable jamb anchors constructed of not less than 14 gage material. Provide jamb anchors at 16 inches on center.
- i. Welded frames that are to be installed in previously prepared masonry openings shall be 1/2 inch smaller in width and 1/4 inch smaller in height than the masonry opening to provide 1/4 inch clearance on all sides.
- j. Removable glass stop for view window frame shall consist of 10 gage angle securely fastened to the frame using machine screws of 1/4 by 1 1/4 inch spaced at 8 inches on center maximum. Exposed screw heads shall be round, pan, or oval type, and shall be torx drive, tamperproof. The finished glass stop shall be tight fitting and mitered at the corner joints. There shall be a minimum of one inch glass engagement. Install plaster guards covering the glass stop screws on masonry grouted frames.
- k. When shipping limitations dictate, frames for large openings shall be fabricated in sections designed for field welded splicing. Welds shall be ground smooth and primed for painting. Sections shall be assembled at the factory to ensure proper fit and be clearly marked for field reassembly.

### 2.2.3 Door Reinforcement for Hardware

- a. Mortise, reinforce, drill, and tap doors at the factory for mortised hardware in accordance with the approved hardware schedule and templates. Doors to receive surface-mounted hardware shall have inner reinforcing plates for drilling and tapping to be performed in the field.
- b. For each mortised hinge, provide a reinforcing plate measuring  $3/16$  by  $1\ 1/2$  by 10 inches that is continuously welded inside the edge channel. The top hinge preparation shall be additionally braced by a channel, welded to the back of the hinge reinforcing plate and inside the edge reinforcing channel.
- c. Where detention locks are scheduled, provide reinforced pocket to receive locks. The secure side of the door shall be finished flush with a  $3/16$  inch backup plate to protect lock. Form the pocket perimeter of 12 gage channels on three sides with the door edge channel completing the perimeter frame. Do not cut the door edge channel except for passage of the lock bolt. Provide a  $3/16$  inch thick steel mounting and protection plate to cover the lock pocket and extend at least  $3/4$  inch on three sides beyond the cutout. Secure the lock to the protection plate in accordance with the lock manufacturer's instructions. Secure the cover plate to the door by at least six  $1/4$  inch security-type machine screws. Make provisions so that removal of the lock is impossible when the lock bolt is extended.
- d. Reinforcements for door pulls shall be  $3/16$  inch steel welded inside door. Reinforcement size shall be  $1\ 1/2$  by 10 inches for loop type pull and 6 by 7 inches for flush type pull. Minimum 12 gage reinforcing shall be welded inside the door for all other surface hardware items.

### 2.2.4 Frame Reinforcement for Hardware

- a. Mortise, reinforce, drill, and tap frames at the factory for templated mortised hardware, in accordance with the approved hardware schedules and templates. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates completely drilled and tapped for installation in the field.
- b. For each mortised hinge, provide a 7 gage, off-set reinforcing plate that is factory drilled and tapped and measures  $1\ 1/2$  by 10 inches. Top hinge reinforcement shall be additionally braced by a 7 gage backup angle welded to the reinforcement and to the inside of the frame trim.
- c. Where electrical frame-mounted locks are used, provide a special housing with a 7 gage backup for attachment of the lock and a lock cover plate of the same thickness. Provide a junction box or enclosure behind each item of electrical hardware on the frame. Conduit shall be factory installed between interconnecting electrical items within each frame.
- d. All other mortised and surface-mounted hardware reinforcements shall be not less than 12 gage.

### 2.2.5 Factory Finishing

- a. After fabrication, dress, fill, and sand tool marks and surface imperfections to make faces and vertical edges smooth, level, and free of irregularities.
- b. Surfaces shall be chemically treated and cleansed of rust, oil, and impurities and given a phosphate treatment to ensure paint adhesion.
- c. Paint exposed surfaces of doors, and both inside and outside of frames with a minimum of one-mil thickness of rust inhibitive primer which shall be dried and completely cured to develop hardness before shipment.

### 2.3 ACCESS PANELS

Provide steel access panels of sizes and locations as indicated and where required for access to utilities, equipment, and controls.

- a. Doors shall be 10 gage steel, flanged 1.25 inches on four sides, with welded corners.
- b. Frame shall be composed of steel angles measuring 3/16 by 2 by 2 inches. Weld and grind joints smooth.
- c. Provide detention type hinges with nonremovable pin, three per frame. Weld to door and frames.
- d. Weld steel stop angles measuring 1/8 by one by one inch to frame on all four sides.
- e. Masonry anchors shall be welded at factory, 1/8 by one inch by 6 inches, minimum four per panel. [Provide expansion shields at concrete openings, factory countersunk for 3/8 inch flathead machine screw, minimum two per jamb.]
- f. Factory finish with prime coat of rust-inhibitive, baked-on enamel.
- g. Provide locks at panels within the security perimeter [and points of egress from ducts and tunnels terminating outside the security perimeter]. Lock case and cover shall be malleable iron and steel. Bolt shall be high strength bronze and project 3/4 inch from case when retracted and have a throw of not less than 5/8 inch. Locks shall have five tumblers, each actuated by phosphor bronze springs. Locks shall operate from one side only. Attach to panel with detention type screws. Locks shall be keyed alike. Enter coded keys into keying system as specified in Section 08 71 63 DETENTION HARDWARE.

### 2.4 OPENING PROVISION

[Speaking ports] [Louvers] [View ports] [Food passes] shall be manufactured as indicated.

### 2.5 SOURCE QUALITY CONTROL

Prior to fabrication, perform the following minimum performance test on a 12 gage reinforced flush door of the type to be provided on this project:

- a. Test "A" - Static Load: Under centrally applied load of 14,000 pounds ( 660 pounds per square foot) at quarter points, the maximum permitted deflection shall be 0.58 inch with a rebound of 0.015 inch after release of load.

- b. Test "B" - Rack Test: Under a concentrated load of 7,500 pounds on one unsupported corner of door, the maximum deflection shall not exceed 3.5 inches without failure.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Door Schedule

Refer to door schedule on drawings for location of doors, door frames, and door hardware.

##### 3.1.2 Frames

Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After completing wall construction, remove temporary braces and spreaders. Do not use any part of the frame as lintels or load-carrying members. Anchor frame to masonry with flat head security type machine screws into expansion shields or attached to a pre-set rough buck anchored to the masonry in the same way. Install five anchors on each jamb for doors up to and including 7 feet 6 inches in height and six on each jamb for taller doors.

##### 3.1.3 Doors

Fit hollow metal doors accurately in frames. Provide metal shims where necessary.

##### 3.1.4 Access Panels

Prepare openings as required to receive frame. Use fasteners as specified and required by type of surrounding construction. Ensure that frames are properly seated into opening with steel shims and that doors are true, in alignment, and completely flush in appearance. Maintain 1/8 inch maximum clearance between door and frame.

#### 3.2 ADJUSTMENT AND CLEANING

Remove and replace defective work which is warped, bowed, or otherwise damaged. Adjust hollow metal work for smooth operation. Touch up scratches and bare edges in the field with a rust inhibiting primer prior to painting.

-- End of Section --

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## SECTION 08 34 73

## SOUND CONTROL DOOR ASSEMBLIES

11/19, CHG 1: 02/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A108 (2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A568/A568M (2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM A1008/A1008M (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM C143/C143M (2020) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C476 (2020) Standard Specification for Grout for Masonry

ASTM C1036 (2021) Standard Specification for Flat Glass

ASTM D1056 (2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

ASTM D4689 (2012) Standard Specification for Adhesive, Casein-Type

ASTM D6386	(2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E336	(2020) Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
ASTM E413	(2022) Classification for Rating Sound Insulation
ASTM E1289	(2008; R 2022) Standard Specification for Reference Specimen for Sound Transmission Loss

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines
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## UNDERWRITERS LABORATORIES (UL)

UL 10C	(2016; Reprint May 2021) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies
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## WOODWORK INSTITUTE (WI)

NAAWS 3.1	(2017; 2018 Errata Edition) North American Architectural Woodwork Standards
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:



## SD-02 Shop Drawings

## Fabrication Drawings

## SD-03 Product Data

Hollow Metal Sound Retardant Doors[; G[, [\_\_\_\_]]]

Wood Sound Retardant Doors[; G[, [\_\_\_\_]]]

Door Frames[; G[, [\_\_\_\_]]]

Door Hardware[; G[, [\_\_\_\_]]]

Door Frame Sound Infill[; G[, [\_\_\_\_]]]

[ Vision Panels[; G[, [\_\_\_\_]]]

][ Intumescent Seals and Gasketing[; G[, [\_\_\_\_]]]

] Thresholds[; G[, [\_\_\_\_]]]

[ Astragals[; G[, [\_\_\_\_]]]

## ] SD-06 Test Reports

Wind Loading Tests[; G[, [\_\_\_\_]]]

Water Leakage Tests[; G[, [\_\_\_\_]]]

Acoustical Tests[; G[, [\_\_\_\_]]]

Air Infiltration Tests[; G[, [\_\_\_\_]]]

Positive Pressure Tests[; G[, [\_\_\_\_]]]

## SD-07 Certificates

Hollow Metal Sound Retardant Doors[; G[, [\_\_\_\_]]]

Wood Sound Retardant Doors[; G[, [\_\_\_\_]]]

Door Frames[; G[, [\_\_\_\_]]]

Door Hardware[; G[, [\_\_\_\_]]]

[ Vision Panels[; G[, [\_\_\_\_]]]

][ Intumescent Seals,Gasketing [and Door Bottoms][; G[, [\_\_\_\_]]]

] Thresholds[; G[, [\_\_\_\_]]]

[ Astragals[; G[, [\_\_\_\_]]]

] Assembly Test Reports

## 1.3 QUALITY CONTROL

Ensure work within this section is designed and furnished by one

manufacturer, who has been engaged in the manufacture of Sound Retardant [Wood Swinging Door] [Hollow Metal Door] [\_\_\_\_\_] systems for at least five years prior to the start of this work.

Provide acoustic assemblies manufactured by a single source specializing in the production of this type work for a minimum of five years.

### 1.3.1 Compliance and Labeling

#### 1.3.1.1 Compliance with Accessibility Requirements

Americans with Disabilities Act/Architectural Barriers Act (ADA/ABA)  
36 CFR 1191

Accessibility Guidelines for Buildings and Facilities (ADAAG) 36 CFR 1191

[\_\_\_\_\_] (Insert appropriate accessibility standard)

#### 1.3.1.2 Category A Positive Pressure Fire Door Construction

Where requirements for positive pressure are met, include for doors all requirements as part of the door construction per Category A guidelines as published by ITS/Warnock-Hersey. Intumescent is not allowed on the frame. Applying smoke gasketing around the perimeter of the frame to meet the "S" smoke rating is permissible in instances where smoke control is required.

#### 1.3.1.3 Category B Positive Pressure Fire Door Construction

Conform all door openings to the applicable portions of NFPA 101 and NFPA 252. Incorporate field applied intumescent materials, applied by a licensed installer according to the manufacturers' instructions. Keep instructions on file. Additional gasketing may be required to meet the 'S' smoke rating. Submit Certificate for intumescent seals, gasketing[ and door bottoms].

#### 1.3.1.4 Labeling

Ensure all positive pressure door assemblies carry the fire label for the complete opening, clearly identifying the:

- a. Manufacturer
- b. Third party testing and certification agency
- c. Fire door rating
- d. Installation limitations
- e. Compatible frame, hardware component ratings
- f. Compatible lite or vision panel component ratings
- g. Required building code information, including temperature and smoke rating
- g. STC rating if required.

Indicate fire-ratings of applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by

36 CFR 1191 Appendix D - Technical.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Ship all doors in the manufacturer's undamaged individual cartons, securely bundled and wrapped with moisture-resistant covers and stored in accordance with the manufacturer's printed instructions in a dry, clean, and ventilated area.

Deliver and store wood doors in the building following the installation of concrete, terrazzo, plaster, or other wet materials, and only after the building has dried out and has a roof.

Store all materials on planks in a dry location. Store doors and frames vertically with minimum [\_\_\_\_\_] airspace between. Store doors on the edge to eliminate any potential damage to the door bottom seal. Cover all material to protect from damage but in a manner to allow proper circulation.

Maintain relative humidity in the building between 30 and 65 percent. Maintain the ambient temperature at 60 degrees F minimum at the time of installation of wood doors.

Perform final adjustment of seals when temperatures and humidity conditions replicate the interior conditions that will exist when the building is occupied.

#### 1.5 WARRANTY

Manufacturer's warranty for [\_\_\_\_\_] [5] years from date of supply, covering material and workmanship. Failures include, but are not limited to, the following:

- a. Failure to meet sound rating requirements
- b. Faulty operation of sound seals
- c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide sound retardant door assemblies of the thickness, width, and height indicated, complete with perimeter seals, seal housings, gasketing, [automatic door bottoms,] thresholds, door frames, and astragals as required to conform to the specified STC per ASTM E90 and ASTM E1289.

Submit fabrication drawings for [Hollow Metal Sound Retardant Doors,] [Wood Sound Retardant Doors,] Door Frames and Door Frame Sound Infill.

Submit certificates showing conformance with the referenced standards in this section, and manufacturer's catalog data including STC ratings and UL fire rating, where applicable, for the following items: Hollow metal sound retardant doors; wood sound retardant doors; door frames; door hardware; [vision panels]; [intumescent seals and gasketing]; thresholds; [ and] [astragals].

Provide assemblies that are complete with metal frame, wood door(s),

sealing system, and Cam-lift hinges (when required). [ If vision lights are specified for doors, provide metal loose stops and field install glass and glazing when shipped separately.]

### 2.1.1 Design Requirements

#### 2.1.1.1 Door Design

Provide sound Retardant Wood Swinging Doors that are a 1-3/4-inch thickness construction with sizes as indicated on drawings. No visible seams are permitted on door faces. Provide face gauges, internal sound retardant core and perimeter door edge construction per manufacturer's standard for the specified STC rating. No lead or asbestos is permitted in door construction to achieve STC performance. Provide face veneer species cut and color as selected from manufacturer's full range of available colors and patterns. No lead or asbestos is permitted in door construction to achieve performance requirements.

#### 2.1.1.2 Frame Design

Provide sound Retardant Metal Frames conforming to ASTM A1008/A1008M, not less than 0.0747-inch thick, and free from pitting, scale, stretcher strains, fluting, and surface defects with integral trim and shipped with temporary spreader. Knockdown frames are not acceptable.

Provide frames with 2 inch faces, profiles and dimensions as indicated, with mitered reinforced corners, welded the full depth of frame and trim, with exposed surfaces ground smooth and flush. Close contact edges to hairline joints.

### 2.1.2 Performance Requirements

#### 2.1.2.1 STC (Sound Transmission Classification) Rating

Provide doors with an STC [of at least [25] [30] [35] [40] [45]] [per the door schedule].

## 2.2 FABRICATION

Provide doors that are minimum 16 gauge, 1 3/4 inch thick with welded, seamless construction. No visible joints are permitted on the exposed faces or edges. Join door skins at vertical edges by continuous welds, ground and dressed smooth to provide a flush finish. Reinforce top and bottom with 16 gauge continuous inverted steel channels spot welded to both faces. Finish both top and bottom to provide a smooth flush condition. Bevel both vertical edges 1/8 inch in 2 inches.

Clean and sand to smooth finish all doors to remove handling and storage marks, raised grain, minor surface marks and abrasions which are to receive a job site finish.

#### 2.2.1 Hollow Metal Sound Retardant Doors

##### 2.2.1.1 Construction

Conform to ASTM A1008/A1008M for door construction utilizing steel facing sheets. Conform stretcher level flatness to ASTM A568/A568M; not less than 0.0598 inch thick; free from pitting, scale, and surface defects; separated by a core construction designed to meet the required STC; and tested and

rated in accordance with [ASTM E90](#).

Provide doors that have flush seamless face sheets and vertical edges, with continuous welded and smooth joints. Provide edges that are flush or rabbeted as required for perimeter seals.

Provide door surfaces that are visually flat and free from warp, waviness, and other surface irregularities and defects. Maximum allowable warp or twist-can not exceed [1/8 inch](#) when measured with a [7 foot](#) straightedge along the diagonal and not exceed [1/16 inch](#) when measured with a [7 foot](#) straightedge in the width or in any position along the length of the door.

Provide hardware reinforcement that is steel drilled, tapped to template requirements and welded in place. Provide minimum thicknesses as follows:

- a. Butts, [0.1494 inch](#)
- b. Lock strike, [0.1196 inch](#)
- c. Surface applied hardware [0.0747 inch](#)

Provide doors, including sound retardant type, to bear the UL [3-hour A] [1-1/2-hour B] [3/4-hour C] [1-1/2-hour D] label fire rating and the specified STC.

#### 2.2.1.2 Coating

Thoroughly clean all mill scale, rust, oil, grease, dirt, and other foreign materials from surfaces before the application of the shop coat of paint.

After cleaning, provide galvanized surfaces free of paint in accordance with [ASTM D6386](#), Method A, B, C, or D.

Apply to clean prepared dry surfaces one shop coat of rust inhibitive metallic oxide or synthetic resin primer by brush, dipping, or other approved method to provide a continuous minimum dry film thickness (dft) of [0.9 mil](#).

Shop paint the exposed door surfaces, including surfaces that are galvanized.

Shop paint the concealed exterior door surfaces except galvanized surfaces.

#### 2.2.2 Wood Sound Retardant Doors

Construct doors with wood veneer facings separated by a core construction designed to meet the required STC. Test, rate, and label in accordance with [ASTM E90](#).

Comply with the [NAAWS 3.1](#), "Guide Specifications and Quality Certification Program," for [premium] [custom] [economy] grade constructions and to the requirements specified.

Perform beveling, prefitting, machining, mortising, and routing for hardware, perimeter seals, and door bottom cutouts at the mill.

[ Furnish [premium] [custom] [economy] grade door facings with standard thickness face veneers conforming to [NAAWS 3.1](#), Type 1 for stain and transparent job site-applied finish.

] [Apply medium density overlay door facings over a good grade of hardwood conforming to [NAAWS 3.1](#), Type 3 for job site-applied paint finish.

] [Furnish plastic laminate door facings, [1/16 inch](#) thick, in decorator color and patterns as selected, conforming to [NAAWS 3.1](#), Type 4.

#### ] 2.2.2.1 Faces

Single-ply wood veneer not less than [1/50 inch](#) thick.

- a. Species: [Anigre] [Select white ash] [Figured select white ash] [Select white birch] [Select red birch] [Cherry] [Select red gum] [Figured select red gum] [Select white maple] [Red oak] [White oak] [Persimmon] [Sapele] [Sycamore] [Walnut] [\_\_\_\_\_].
- b. Cut: [Rotary cut] [Plain sliced (flat sliced)] [Quarter sliced] [Rift cut].
- c. Match between Veneer Leaves: [Book] [Slip] [Random] match.
- d. Assembly of Veneer Leaves on Door Faces: [Center-balance] [Balance] [Running] match.
- e. Pair and Set Match: Provide for doors hung in same opening[ or separated only by mullions].
- f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by [[10 feet](#)] [[20 feet](#)] [\_\_\_\_\_] or more.
- g. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- h. Transom Match: [Continuous match] [End match] [As indicated].
- i. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling.

#### 2.2.3 Door Finishing

Conform factory finishing of Sound Retardant Wood Swinging Doors in accordance with AWI Quality Standards. Provide factory finish of a water-base stain and ultraviolet (UV) cured polyurethane sealer to comply with EPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations. Conform finish to meet or exceed performance standards of [NAAWS 3.1](#) catalyzed polyurethane.

### 2.3 COMPONENTS

#### 2.3.1 Frames

Construct frames for Sound Retardant Wood Swinging Doors from formed sheet steel or structural shapes and bars. Provide sheet steel that is commercial quality, level, cold rolled steel conforming to [ASTM A1008/A1008M](#) or hot rolled, pickled and oiled steel conforming to [ASTM A1011/A1011M](#). Comply steel shapes with [ASTM A36/A36M](#) and steel bars with [ASTM A108](#), Grade 1018.

### 2.3.2 Door Frame Sound Infill

[ Grout: Comply with [ASTM C476](#), with a slump of not more than [4 inches](#) as measured according to [ASTM C143/C143M](#).

] [Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for [15 mil](#) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

] Select the appropriate infill material [\_\_\_\_\_].

### 2.3.3 Hardware Reinforcements

Factory mortise, reinforce, drill and tap frames for all mortise hardware as required by hardware manufacturer's template. Provide necessary reinforcement plates as required for surface mounted hardware; installer to perform all field drilling and tapping. Provide dust cover boxes on all frame mortises. Provide minimum thicknesses as follows:

- a. Butts, [3/16 inch](#)
- b. Lock strike, [0.1196 inch](#)
- c. Surface applied hardware [0.0747 inch](#)

### 2.3.4 Jamb Anchors

Provide number and spacing of anchors as follows:

#### 2.3.4.1 Masonry Type

Locate anchors not more than [18 inches](#) from top and bottom of frame. Space anchors not more than [32 inches](#) o.c. and as follows:

- a) Two anchors per jamb up to [60 inches](#) in height.
- b) Three anchors per jamb from [60 to 90 inches](#) in height.
- c) Four anchors per jamb from [90 to 96 inches](#) in height.
- d) Four anchors per jamb plus one additional anchor per jamb for each [24 inches](#), or fraction thereof, more than [96 inches](#) in height.

#### 2.3.4.2 Stud-Wall Type

Locate anchors not more than [18 inches](#) from top and bottom of frame. Space anchors not more than [32 inches](#) o.c. and as follows:

- a) Three anchors per jamb up to [60 inches](#) in height.
- b) Four anchors per jamb from [60 to 90 inches](#) in height.
- c) Five anchors per jamb from [90 to 96 inches](#) in height.
- d) Five anchors per jamb plus one additional anchor per jamb for each [24 inches](#), or fraction thereof, more than [96 inches](#) in height.

- e) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

#### 2.3.4.3 Post-installed Expansion Type

Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

#### 2.3.5 Door Hardware

Provide the following STC related hardware with the door; [cam-lift hinges] [, perimeter seals] [, astragals] [, door bottoms] [, thresholds] [, hardware standoff brackets] and [\_\_\_\_\_].

Include on Fabrication drawings a finish hardware schedule for each door and a hollow metal door frame schedule for each door indicating profile, dimensions, hardware reinforcement, and frame anchorage. Also indicate perimeter seals, door-bottom devices and other hardware items that are assembled in the shop.

Refer to Section 08 71 00 DOOR HARDWARE for remaining hardware requirements.

#### [2.3.6 Vision Panels

Furnish doors with vision panels complete with glazing. Provide 0.0747 inch steel or wood frames, moldings, and stop to match the door finish, with profile indicated. Assemble with mitered corners and flush joints, and secured with countersunk phillips-head screws.

Provide either a single thickness of acoustical plate glass laminated to an inner face of water-clear plastic or multiple thicknesses of 1/4 inch plate glass, clear or patterned as indicated, and set in glazing gaskets and frames as required to meet the specified STC.

Provide glass to conform to ASTM C1036, Type I, Class 1. Provide acoustical plate glass that has been tested and rated in accordance with ASTM E90, with an STC of not less than 36 and a minimum thickness of 9/32 inch.

#### ]2.3.7 Head and Jamb Seals

[ Provide a closed-cell, expanded cellular rubber Seal material conforming to ASTM D1056, Type S, Grade SBE-42 or SCE-42 for heads, jambs[, and door bottoms].

] Install seals in formed steel or extruded aluminum shapes designed to receive and hold seals and to provide concealed adjustable attachment to door frames. Provide concealed adjustment screws that are not more than 12 inches on center and provide at least 3/8 inch adjustment.

#### ]2.3.8 Door Bottoms

Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.

##### 2.3.8.1 Automatic Door Bottoms

Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom



edge of door with screws.

Mounting: [Mortised or semimortised into bottom of door] [or] [surface mounted on face of door] as required by testing to achieve STC rating indicated.

#### 2.3.9 Thresholds

Provide metal thresholds where indicated. Provide thresholds that are extruded aluminum, 6063-T5 alloy, mill finish, not less than 1/8 inch thick, with integral seal grooves formed to the indicated section.

Provide flat, smooth, unfluted thresholds as recommended by manufacturer; fabricated from [aluminum] [stainless steel] [solid wood matching wood door faces].

- a. Finish: [Clear] [Color] anodic finish.
- b. Color: [Light bronze] [Medium bronze] [Dark bronze] [Black] [Match Architect's sample] [As selected by Architect from full range of industry colors and color densities].

Provide hardwood thresholds where indicated made of clear, all-heartwood, free of streaks, pin or worm holes, uniform in color, free of defects, finish sanded, and ready for job site, transparent or paint finish.

#### [2.3.10 Astragals

[ Provide steel astragals for the inactive leaf of each pair of doors, as indicated. Surface mount to the door by welded connections or by countersunk, flat-head screws, within integral groove to receive perimeter seal material.

] [Provide wood astragals for the inactive leaf of each pair of doors. Provide astragals that are solid hardwood. Match the veneer and finish of doors. Surface mount to doors by screw fasteners or with waterproof and mold-resistant adhesive conforming to [ASTM D4689](#), Type II.

### ]2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

#### 2.4.1 Sound Transmission Classification

Provide test reports prepared by a nationally recognized, independent laboratory for Acoustical Tests, Air Infiltration Tests, Wind Loading Tests, and Water Leakage Tests indicating that the sound transmission classification (STC) of the proposed door, based on tests at 16 third-octave band frequencies from 125 to 4,000 hertz, is no less than the specified STC when tested in accordance with [ASTM E90](#), and that the door tested is hung in substantially the type of wall and frame as indicated and is fully operable with hardware and perimeter seals installed.

#### 2.4.2 Positive Pressure

Provide test reports, prepared by a nationally recognized, independent laboratory for Positive Pressure Tests, for all fire rated door assemblies, including Intumescent Seals, Gasketing[, and Door Bottoms].

#### 2.4.3 Cam Lift Hinges

When required to achieve STC, manufacturer to furnish laboratory test data certifying hinges have been cycled a minimum of 1,000,000 while supporting a minimum door weight of 350 pounds.

Full-mortise template type that raises the door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.

#### 2.4.4 Guarantee

Provide written guarantee that each door delivered to the project is equal in construction, sound transmission classification (STC), and positive pressure test rating where applicable, with appropriate labeling and markings, to that of the sample door tested. Clearly state in written guarantee that each door assembly, when installed in accordance with the manufacturer's printed instructions, has an in-place STC within 3 decibels of the specimen tested. Submit the following test data and Certificates with the written Guarantee:

- a. Wind Loading Tests
- b. Water Leakage Tests
- c. Acoustical Tests
- d. Air Infiltration Tests
- e. Positive Pressure Tests

### PART 3 EXECUTION

#### 3.1 PREPARATION

Upon receipt of material, thoroughly inspect all frames, doors and accessories. Verify quantities and tag numbers according to the packing list provided. Report all discrepancies, deficiencies and/or damages immediately to Contracting Officer.

Prior to installation check all doors and frames for correct size and swing. Verify that frames are plumb, square and aligned without twist in accordance with tolerances published by NAAMM/HMMA and SDI.

##### 3.1.1 Frame Painting and Cleaning

Clean thoroughly all surfaces of all mill scale, rust, oil, grease, dirt, and other foreign materials before the application of the shop coat of paint.

Apply one shop coat of rust inhibitive metallic oxide or synthetic resin primer applied to clean, dry, and prepared surfaces by brush, dipping, or other approved method to provide a continuous minimum dry film thickness of 0.9 mil.

#### 3.2 INSTALLATION

##### 3.2.1 Frame

Install frames plumb and true with not more than 1/32 inch deviation in vertical alignment in 8 feet. Anchor to the wall in accordance with the manufacturer's instructions. Grout frames solid with mortar in masonry,

concrete, and plaster wall construction. Spot grout frames in dry wall partitions with mortar at the jamb anchor clips; fill the space between metal frame and stud partition solidly with fiberglass or mineral wool insulation.

Field splices may be required after installation because of shipping limitations. Field weld splices by certified welders per manufacturer's instructions and in accordance with [AWS D1.3/D1.3M](#).

### 3.2.2 Door

Install and adjust all doors, hardware, and seals in accordance with the approved drawings, hardware schedules, and the printed instructions of the door manufacturer.

Install and adjust perimeter seals [and automatic door bottom seals] to provide positive compression contact with the entire sealing surface with no gaps, openings, or breaks. Hinges or hardware which distort or pinch the perimeter seal during operation of the door will be rejected.

Install door bottom devices to seal the space between the door bottoms and the finished floor and the space between the seal and seal housing.

Field apply perimeter seal housings with mitered corners and with flush, aligned hairline joints.

[ Install wood doors and frames in accordance with [NFPA 80](#) [UL 10C](#) ].

] Install components to manufacturer's written instructions. Coordinate with [masonry] [gypsum board] [concrete] [\_\_\_\_\_] wall construction for anchor placement. Set frames plumb, square, level and at correct elevation. Adjust operable parts for correct clearances and function. Install and adjust perimeter and bottom acoustic seals.

### [3.3 FIELD QUALITY CONTROL

Provide third party testing in accordance with [ASTM E336](#). Verify in writing that installed product performs no less than five (5) ASTC or NIC rating points below the specified laboratory STC rating. Examine, adjust, and retest any installation not meeting that criteria until compliance is obtained.

#### 3.3.1 Testing and Performance

Provide assemblies that are identical to those tested at an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST) in accordance with [ASTM E90](#) and [ASTM E413](#). For the [assembly test reports](#) include the laboratory name, test report number and date of test.

] -- End of Section --

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## SECTION 08 36 13

## SECTIONAL OVERHEAD DOORS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A227/A227M (2017) Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs

ASTM A229/A229M (2018) Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM E330/E330M (2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

## DOOR AND ACCESS SYSTEM MANUFACTURERS ASSOCIATION (DASMA)

ANSI/DASMA 102 (2011) Specifications for Sectional Overhead-Type Doors

ANSI/DASMA 108 (2017) Standard Method for Testing

Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 (2006) Metal Finishes Manual

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA MG 1 (2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

NEMA ST 20 (2014) Dry-Type Transformers for General Applications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 325 (2017; Reprint Feb 2020) UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G[, [\_\_\_\_\_]]

SD-03 Product Data

Doors; G[, [\_\_\_\_]]

[ Electric Operators; G[, [\_\_\_\_]]

] SD-08 Manufacturer's Instructions

Doors

SD-10 Operation and Maintenance Data

Doors, Data Package 2; G[, [\_\_\_\_]]

#### 1.2.1 Shop Drawing Information

Show types, sizes, locations, metal gages including minimum metal decimal thickness, hardware provisions, installation details, and other details of construction. [ For electrically-operated doors, include supporting brackets for motors, location, type, and ratings of motors, switches, and safety devices.]

#### [1.2.2 Electric Operators Product Data

For electrically motor-operated doors, submit manufacturer's wiring diagrams for motor and controls.

#### ]1.3 DELIVERY, STORAGE, AND HANDLING

Protect doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store doors in dry locations with adequate ventilation, free from dust and water. Remove damaged items and provide new. Provide easy access for inspection and handling of overhead doors prior to installation.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Hard-Drawn Springwire

ASTM A227/A227M.

##### 2.1.2 Oil-Tempered Springwire

ASTM A229/A229M.

##### 2.1.3 Steel Sheet

ASTM A653/A653M.

##### 2.1.4 Steel Shapes

ASTM A36/A36M.

##### 2.1.5 Aluminum Extrusions

ASTM B221, Alloy 6063-T5.

##### 2.1.6 Aluminum Sheets and Strips

ASTM B209, alloy and temper best suited for the purpose.

#### 2.1.7 Glass

[Fully tempered, clear float glass] [Double strength, clear glass] [1/8] [\_\_\_\_\_] inch thick.

### 2.2 DOORS

Doors must comply with ANSI/DASMA 102. Metal doors to have horizontal sections hinged together which operate in a system of tracks to completely close the door opening in the closed position and make the full width and height of the door opening available for use in the open position. Provide a permanent label on the door indicating the name and address of the manufacturer. Provide doors with [standard lift type designed to slide up and back into a horizontal overhead position and requiring a maximum of 16 inch of headroom for 2 inch tracks and 21 inch of headroom for 3 inch tracks] [low headroom type designed to slide up and back into a horizontal overhead position and requiring a maximum of 10 inch of headroom for 2 inch tracks and 12 inch of headroom for 3 inch tracks] [high lift type designed to slide up and back into a combination vertical and horizontal position] [vertical lift type designed to slide upward into a vertical position]. Doors operate [by lifting handles] [by hand chain with gear or sprocket reduction] [by hand crank with gear or sprocket reduction] [by electric power with auxiliary hand chain operation].

### 2.3 DESIGN REQUIREMENTS

Design wind load must [conform to the design wind load for the building] [withstand a wind pressure of [a minimum of plus or minus 13.3] [\_\_\_\_\_] pounds per square foot] of door area without damage. Doors must be tested in accordance with either ASTM E330/E330M or ANSI/DASMA 108 and must meet the acceptance criteria of ANSI/DASMA 108.

### 2.4 FABRICATION

#### 2.4.1 Steel Overhead Doors

Form door sections of hot-dipped galvanized steel not lighter than [ 20 gage with longitudinal integral reinforcing ribs] [ or ] [ 24 gage with longitudinal integral reinforcing ribs and flat bottom V-grooves]. Install sections not less than 2 inch in thickness. Meeting rails to have interlocking joints to ensure a weathertight closure and alignment for full width of the door. Provide sections of the height indicated or the manufacturer's standard. Do not exceed thick 24 inch height for intermediate sections. Bottom sections may be varied to suit door height. Do not exceed 30 inch height for bottom section. [ Provide glass panels and install panels using manufacturer's standard for rubber gaskets.]

##### 2.4.1.1 Insulated Sections

Insulate door sections with plastic foam or other material providing a "U" factor of 0.27 or less. Cover interior of door sections with steel sheets of not lighter than 27 gage to completely enclose the insulating material.

##### [2.4.1.2 Aluminum Sections

At the Contractor's option, door sections may be constructed of aluminum in lieu of steel. Provide the same structural and thermal properties for



aluminum sections as specified for steel sections.

#### ]2.4.2 Aluminum Panel Overhead Doors

Provide door panel construction with extruded aluminum stiles and rails with aluminum[ and glass] panels. Stiles and rails has a minimum wall thickness of 0.060 inch. Meeting rails shall have interlocking joints to ensure a weathertight closure and alignment for full width of door. Provide sections to the height indicated or the manufacturer's standard, but the height of an intermediate section not to exceed 24 inch. Bottom sections may be varied to suit door height, but to not exceed 30 inch in height. Provide aluminum panels not less than 0.040 inch in thickness. Install panel using a continuous vinyl gasket and snap-in type of aluminum or vinyl glazing bead.[ Install glass panels as specified for aluminum panels.]

#### ]2.4.3 Tracks

Provide galvanized steel tracks not lighter than 14 gage thick for 2 inch tracks and not lighter than 12 gage thick for 3 inch tracks. Provide galvanized steel vertical tracks with continuous galvanized steel angle not lighter than 13 gage for installation to walls. Incline vertical track through use of adjustable brackets to obtain a weathertight closure at jambs. Reinforce horizontal track with galvanized steel angle; support from track ceiling construction with galvanized steel angle and cross bracing to provide a rigid installation.

#### 2.4.4 Hardware

Provide hinges, brackets, rollers, locking devices, and other hardware required for complete installation. Install roller brackets and hinges with 14 gage galvanized steel. Provide rollers with ball bearings and case-hardened races. Provide reinforcing on doors where roller hinges are connected. Provide a positive locking device and cylinder lock with two keys on manually operated doors.

#### 2.4.5 Counterbalancing

Counterbalance doors with an oil-tempered, helical-wound torsional spring mounted on a steel shaft. Provide adjustable spring tension, connect spring to doors with cable through cable drums. Provide cable safety factor of at least 5 to 1.

### 2.5 MANUAL OPERATORS

#### 2.5.1 Pushup Operators

Provide lifting handles on both sides of door. Do not exceed the lesser of 10 percent of the door weight or 25 pounds for the maximum lifting force of required to operate the door. Provide pulldown straps or ropes at bottom of doors over 7 feet high.

#### 2.5.2 Chain Hoist Operators

Provide a galvanized, endless chain operating over a sprocket. Extend chain to within 4 feet of the floor and mount on inside of building. Obtain reduction by use of roller chain and sprocket drive or gearing. Provide chain cleat and pin for securing operator chain. Allow for future installation of power operators to chain hoist operator. Do not exceed the

maximum lifting force of 35 pounds required to operate the door.

## 2.6 ELECTRIC OPERATORS

### 2.6.1 Operator Features

Operators must be labeled and listed to the requirements of UL 325. Provide operators of the drawbar type or side mount (jack shaft) type as recommended by the manufacturer. Include operators with electric motor, machine-cut reduction gears, steel chain and sprockets, magnetic brake, brackets, pushbutton controls, limit switches, magnetic reversing contactor, a manual chain hoist operator for emergency use, and other accessories necessary for operation. Design electric operator so motor may be removed without disturbing the limit switch timing and without affecting the manual operator. Provide the operator with slipping clutch coupling to prevent stalling the motor. Provide a clutch controlled emergency manual operator so that it may be engaged and disengaged from the floor; do not affect limit switch timing by operation. The manual operator is not required if door can be manual-pushup operated with a force not to exceed 25 pounds. Provide an electrical or mechanical device that disconnects the motor from the operating mechanism when the manual operator is engaged.

### 2.6.2 Motors

NEMA MG 1, high-starting torque, reversible type with sufficient horsepower and torque output to move the door in either direction from any position. Provide a motor to produce a door travel speed of not less than 8 inch or more than one foot per second without exceeding the rated capacity. Motors must be operate on current of the characteristics indicated at not more than 3600 rpm. [ Single-phase motors must not have commutation or more than one starting contact. ] [ Provide motor enclosures with drip-proof type or NEMA TENV type. ]

### 2.6.3 Controls

Provide a motor for each door with an enclosed, across-the-line type, magnetic reversing contactor, thermal overload and undervoltage protection, solenoid-operated brake, limit switches, and control switches. Locate control switches at least 5 feet above the floor so the operator will have complete visibility of the door at all times. Provide control equipment to conform to NEMA ICS 1 and NEMA ICS 2. Provide control enclosures with NEMA ICS 6, Type 12 or Type 4, except that contactor enclosures may be Type 1. Provide a three-button type control switch stations with buttons marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" buttons must require only momentary pressure to operate. The "CLOSE" button must require constant pressure to maintain the closing motion of the door. If the door is in motion and the "STOP" button is pressed or the "CLOSE" button released, the door must stop instantly and remain in the stop position; from the stop position, the door may be operated in either direction by the "OPEN" or "CLOSE" button. Provide full-guarded type pushbuttons to prevent accidental operation. Provide limit switches to automatically stop doors at the fully open and closed positions. Limit switch positions must be readily adjustable.

### 2.6.4 Entrapment Protection Devices

Provide entrapment protection devices for electrically-operated doors in accordance with UL 325. These devices must immediately stop and reverse the door in its closing travel upon sensing an obstruction in the door

opening or upon failure of the device or any component of the control system. Any momentary door-closing circuit must be automatically locked out and the door must be operable manually or with constant pressure controls until the failure or damage has been corrected. No entrapment protection device must be used as a limit switch, unless its function is specifically intended to do so.

#### 2.6.5 Control Transformers

**NEMA ST 20.** Provide transformers in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.

#### 2.6.6 Electrical Components

**NFPA 70.** Provide manual or automatic control and safety devices, including extra flexible Type SO cable and spring-loaded automatic takeup reel or equivalent device, for operation of the doors. Conduit wiring and mounting of controls are specified in the corresponding electrical specification section.

#### [2.6.7 Hazardous Locations

Conform to **NFPA 70.** In addition to meeting other requirements specified, electrical materials, equipment, and devices for installation in hazardous locations must be specifically approved by Underwriters Laboratories or by an independent testing agency using equivalent standards, for the particular chemical group and the class and division of hazardous location involved.

#### ]2.7 WEATHER SEALS [AND SENSING EDGES]

Provide exterior doors with weatherproof joints between sections by means of tongue-and-groove joints, rabbetted joints, shiplap joints, or wool pile, vinyl or rubber weatherstripping; a rubber, or vinyl adjustable weatherstrip at the top and jambs; and a compressible neoprene or rubber weather seal attached to the bottom of the door. [ On exterior doors that are electrically operated, where a sensing edge is employed, the bottom seal must be combination compressible weather seal and sensing edge for stopping [and reversing] door movement. ] [ On interior doors that are electrically operated, where a sensing edge is employed, the bottom seal must be a compressible type of sensing edge for stopping [ and reversing ] door movement. ]

#### 2.8 FINISHES

Hot-dip galvanize concealed metal surfaces and tracks in accordance with **ASTM A123/A123M.** Hot-dip galvanized and other ferrous metal surfaces, except rollers and lock components, which are galvanized or plated shop primed.

#### 2.8.1 Galvanized and Shop Primed

Provide a zinc coating on specified surfaces, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. Conform to **ASTM A653/A653M** for galvanized coating, coating designation **G60**, for steel sheets, and **ASTM A123/A123M** for assembled steel products. The weight of coatings for assembled products must be as designated in Table I of **ASTM A123/A123M** for the class of material to be coated. Provide a prime coat especially developed for materials treated by phosphates and adapted to application by

dipping or spraying. Repair damaged zinc-coated surfaces with galvanizing repair paint and spot prime. At the Contractor's option, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel topcoat may be applied in lieu of prime coat specified.

#### 2.8.2 Aluminum

Provide a clear anodized finish to aluminum surfaces in accordance with AA-M10-C22-A41 contained in AA DAF45 and NAAMM AMP 500. Pretreat exposed surfaces and apply a [white] [\_\_\_\_\_] baked-on enamel finish in accordance with manufacturer's standard.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

NFPA 70. Install doors in accordance with approved shop drawings and manufacturer's written installation instructions. Lubricate and adjust doors to operate freely.

Provide a weathertight installation and free from warp, twist, or distortion. Adjust and lubricate doors to operate freely.

Provide all items and accessories for a complete installation in every respect.

#### 3.2 ELECTRICAL WORK

NFPA 70. Conduit, wiring, and mounting of controls.

#### 3.3 TESTING

After installation is complete, operate doors to demonstrate installation and function of operators, safety features, and controls. Correct deficiencies.

-- End of Section --

## SECTION 08 36 19

## VERTICAL LIFT DOORS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2016) Specification for Structural Steel Buildings

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM C136/C136M (2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM E330/E330M (2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

## DOOR AND ACCESS SYSTEM MANUFACTURERS ASSOCIATION (DASMA)

ANSI/DASMA 102 (2011) Specifications for Sectional Overhead-Type Doors

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 (2006) Metal Finishes Manual

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 325	(2017; Reprint Feb 2020) UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G[, [\_\_\_\_\_]]

SD-03 Product Data

Doors; G[, [\_\_\_\_\_]]

[ Motors; G[, [\_\_\_\_\_]]]

[ Controls; G[, [\_\_\_\_\_]]]

SD-08 Manufacturer's Instructions

Doors

SD-10 Operation and Maintenance Data

Doors, Data Package 2; G[, [\_\_\_\_\_]]

### 1.2.1 Shop Drawing Information

Show types, sizes, locations, metal gages, hardware provisions, installation details, and other details of construction. [ For electrically operated doors, include supporting brackets for motors, location, type, and ratings of motors, and safety devices. Include wiring diagrams for motors and controls.]

### [1.2.2 Operation and Maintenance Data

For electrically operated doors, include wiring diagrams for motors and controls.

### ]1.3 DELIVERY, STORAGE, AND HANDLING

Protect doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store doors in dry locations with adequate ventilation, free from dust and water. Storage must permit easy access for inspection and handling. Remove damaged items that cannot be restored to like-new condition and provide new items.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Steel Sheet

ASTM A653/A653M.

#### 2.1.2 Steel Shapes

ASTM A36/A36M.

#### 2.1.3 Aluminum Extrusions

ASTM B221, Alloy 6063-T5.

#### 2.1.4 Aluminum Sheets and Strips

ASTM B209, alloy and temper best suited for the purpose.

#### 2.1.5 Glass

Fully tempered, clear float glass, [1/8] [\_\_\_\_\_] inch thick.

### 2.2 DOORS

Doors must consist of multiple sections set one behind the other. Arrange door operation and travel so that sections arrive simultaneously at the full open position. Sections must stack vertically in a compact group above the head of the opening. Provide doors with counterweights. Design doors, components, and methods of installation in accordance with AISC 360 and ANSI/DASMA 102. Design wind loads must be [[20 psf] [\_\_ psf]] positive load and [[20 psf] [\_\_ psf]] negative load. Door wind load performance must be determined in accordance with ASTM E330/E330M. Maximum wind load deflection of the door must not exceed the door height in inches divided by 120 and the door width in inches divided by 120. Doors must be operable during design wind load.

### 2.3 MANUAL OPERATORS

Provide a galvanized, endless chain operating over a sprocket. Extend chain to within 3 feet of the floor and mount on inside of building. Obtain reduction by use of roller chain and sprocket drive or gearing. Provide chain cleat and pin for securing operator chain. Hoist must allow for future installation of electric operators. The force required to operate the door must not exceed 35 pounds.

### 2.4 ELECTRIC OPERATORS

Provide operators of the type recommended by the door manufacturer. Operators must be labeled and listed to the requirements of UL 325. Operators must include electric motor, machine-cut reduction gears, steel chain and sprockets, magnetic brake, brackets, pushbutton controls, limit switches, magnetic reversing contactor, a manual operator as specified above for emergency use, and other accessories necessary for operation. The electric operator must be designed so that the motor may be removed without disturbing the limit switch timing and without affecting the manual operator. The manual operator must be clutch controlled so that it may be engaged and disengaged from the floor; operation must not affect limit switch timing. Provide an electrical or mechanical device that disconnects the motor from the operating mechanism when the manual operator is engaged.

#### 2.4.1 Motors

NEMA MG 1, high-starting torque, reversible type with sufficient horsepower and torque output to move the door in either direction from any position. Motor must produce a door travel speed of not less than two-thirds foot or more than one foot per second without exceeding the rated capacity. Motors must operate on current of the characteristics indicated at not more than 3600 rpm. [Single-phase motors must not have commutation or more than one starting contact. ] [Provide drip-proof type motor enclosures or NEMA totally enclosed non-ventilated (TENV) type. ] Install motors in approved locations.

#### 2.4.2 Controls

Each door motor must have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload and undervoltage protection, solenoid-operated brake, limit switches, and control switches. Locate control switches at least 5 feet above the floor so the operator will have complete visibility of the door at all times. Control equipment must conform to NEMA ICS 1 and NEMA ICS 2. Control enclosures must be NEMA ICS 6, Type 12 or Type 4, except that contactor enclosures may be Type 1. Each control switch station must be of the three-button type; buttons must be marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" buttons must require only momentary pressure to operate. The "CLOSE" button must require constant pressure to maintain the closing motion of the door. If the door is in motion and the "STOP" button is pressed or the "CLOSE" button released, the door must stop instantly and remain in the stop position; from the stop position, the door may be operated in either direction by the "OPEN" or "CLOSE" buttons. Pushbuttons must be full-guarded to prevent accidental operation. Provide limit switches to automatically stop doors at the fully open and closed positions. Limit switch positions must be readily adjustable.

#### 2.4.3 Entrapment Protection Devices



Entrapment protection devices must be provided for electrically operated doors in accordance with [UL 325](#). These devices must immediately stop and reverse the door in its closing travel upon sensing an obstruction in the door opening or upon failure of the device or any component of the control system. Any momentary door-closing circuit must be automatically locked out and the door must be operable manually or with constant pressure controls until the failure or damage has been corrected. No entrapment protection device can be used as a limit switch unless its function is specifically intended to do so.

#### 2.4.4 Control Transformers

[UL 325](#). Provide transformers in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.

#### 2.4.5 Electrical Components

[NFPA 70](#). Provide manual or automatic control and safety devices, including extra flexible Type SO cable and spring-loaded automatic takeup reel or equivalent device, as required for operation of the doors. Conduit, wiring, and mounting of controls are specified in Section [26 20 00 INTERIOR DISTRIBUTION SYSTEM](#).

#### [2.4.6 Hazardous Locations

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by [NFPA 70](#), must be specifically approved by Underwriters Laboratories or by another independent testing agency using equivalent standards, for the particular chemical group and the class and division of hazardous location involved.

#### ]2.5 WEATHER SEALS [AND SENSING EDGES]

Provide exterior doors with weatherproof joints between sections, a rubber or vinyl adjustable weatherstrip at the top, and a compressible neoprene or rubber weather seal attached to the bottom of the door. [ On exterior doors that are electrically operated, where a sensing edge is employed, the bottom seal must be a combination compressible weather seal and sensing edge for stopping [and reversing] door movement. ] [ On interior doors that are electrically operated, where a sensing edge is employed, the bottom seal must be a compressible type of sensing edge for stopping [and reversing] door movement. ]

#### 2.6 FINISHES

Concealed ferrous metal surfaces must be hot-dip galvanized. Exposed ferrous metal surfaces must be hot-dip galvanized and shop primed.

##### 2.6.1 Galvanized and Shop Primed

Surfaces specified must have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating must conform to [ASTM A653/A653M](#), coating designation [G90](#), for steel sheets, and [ASTM A123/A123M](#) for assembled steel products. The weight of coatings for assembled products must be as designated in Table I of [ASTM A123/A123M](#) for the class of material to be coated. The prime coat must be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces by

the application of galvanizing repair paint and spot prime. At the Contractor's option, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel topcoat may be applied to slats before forming in lieu of prime coat specified.

#### 2.6.2 Aluminum

[Surfaces must receive a clear anodized finish, AA-M10-C22-A41, in accordance with [NAAMM AMP 500](#).] [Exposed surfaces must receive a pretreatment and a [white] [\_\_\_\_\_] baked-on enamel finish as standard with the manufacturer.]

### PART 3 EXECUTION

#### 3.1 FABRICATION

##### 3.1.1 Door Sections

Provide vertical and horizontal door section members constructed of structural steel angle or channel shapes. Cover door section exteriors with sheet steel not lighter than [14 gage](#), bolted, plug welded, or edge welded to frame at not more than [9 inches](#) on centers. Provide intermediate horizontal or vertical stiffeners so the maximum unsupported area of sheet is [20 square feet](#). Corners and intersections of frame members must be welded and ground smooth on exposed surfaces. Welds must develop the full strength of frame.

##### 3.1.1.1 Insulated Sections

Insulated door sections must be insulated with material providing a "U" factor of 0.14 or less when tested in accordance with [ASTM C136/C136M](#). Interior of door sections must be covered with steel sheets not lighter than [24 gage](#) to completely enclose the insulating material.

##### 3.1.1.2 Aluminum Sections

At the Contractor's option, door sections may be constructed of aluminum in lieu of steel. Aluminum sections must, as a minimum, provide the same structural and thermal properties as steel sections.

##### 3.1.2 Guides and Jamb Plates

Door sections must run in structural steel guides, securely fastened to the counterweight tower and to the idler tower, which must be attached to the building construction. The counterweight enclosure must extend approximately to the same height as the guides. Set back guides and tower faces on walls to provide clear door opening unobstructed by door guides, except when indicated otherwise.

##### 3.1.3 Hardware

Door sections must be supported by chain or steel cable with a safety factor of five. The sheaves over which the chain or cable passes to the door must have permanently sealed precision bearings. Cast-iron counterweights must be stacked on a steel weight rod or in a special container. The counterweight tower must be enclosed with a removable steel cover not lighter than [14 gage](#) to a height of [7 feet](#) above the floor. Provide doors with a positive locking device and cylinder lock with two keys.

### 3.1.4 Glazing

Provide glass panels where indicated. Install panels using rubber gaskets as standard with the door manufacturer.

## 3.2 INSTALLATION

**NFPA 70.** Install doors in accordance with approved detail drawings and manufacturer's instructions. Accurately locate anchors and inserts for guides, brackets, [motors,] [switches,] hardware, and other accessories. Upon completion, doors must be weathertight and free from warp, twist, or distortion. Doors must be lubricated and adjusted to operate freely.

## 3.3 ELECTRICAL WORK

**NFPA 70.** Conduit, wiring, and mounting of controls are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS.

## 3.4 TESTING

After installation is complete, operate doors to demonstrate installation and function of operators, safety features, and controls. Correct deficiencies.

-- End of Section --

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## SECTION 08 39 53

BLAST RESISTANT DOORS (EARTH COVERED MAGAZINES)  
02/19, CHG 1: 05/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

- ABMA 9 (2015) Load Ratings and Fatigue Life for Ball Bearings
- ABMA 11 (2014) Load Ratings and Fatigue Life for Roller Bearings

## AMERICAN CONCRETE INSTITUTE (ACI)

- ACI 301 (2016) Specifications for Structural Concrete
- ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
- ACI 318M (2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 303 (2016) Code of Standard Practice for Steel Buildings and Bridges
- AISC 325 (2017) Steel Construction Manual
- AISC 360 (2016) Specification for Structural Steel Buildings

## AMERICAN WELDING SOCIETY (AWS)

- AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
- AWS A5.4/A5.4M (2012) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding
- AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel
- AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A242/A242M	(2013; R 2018) Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501/A501M	(2021) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A514/A514M	(2018) Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A529/A529M	(2019) Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A534	(2017; R 2022) Standard Specification for Carburizing Steels for Anti-Friction Bearings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588/A588M	(2019) Standard Specification for High-Strength Low-Alloy Structural Steel,

	up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A618/A618M	(2021) Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2020) Standard Specification for Structural Steel Shapes
ASTM F436	(2011) Hardened Steel Washers
ASTM F844	(2019) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD (DDESB)	
DDESB Technical Paper 15	(2010) Approved Protective Construction
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 101	(2021) Life Safety Code
U.S. DEPARTMENT OF DEFENSE (DOD)	
DOD 5100.76-M	(2012; Change 1-2018; Change 2-2020) Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives
DOD 6055.09-M	(2010; Change 1-2012) DoD Ammunition and Explosives Safety Standards: General Explosives Safety Information and Requirements
MIL-DTL-29181	(2014; Rev C; Notice 3) Hasp, High Security, Shrouded for High and Medium Security Padlock
MIL-DTL-43607	(2015; Rev J; Notice 1) Padlock, Key Operated, High Security, Shrouded Shackle
UFC 3-340-02	(2008; with Change 2, 2014) Structures to Resist the Effects of Accidental Explosions

## 1.2 SYSTEM DESCRIPTION

Provide a **blast resistant door** which fits a door description as follows: [Structural steel doors must be [flush mounted in frames] [or] [surface mounted] [as indicated].] [Doors must be the manually operated, [side hinged, swinging type] [or] [horizontal sliding type]]. Each door assembly must include the door, frame, anchors, hardware, and accessories and must be provided by a single manufacturer. Frames and anchors must be capable of transferring blast reactions to the adjacent supporting structure. Resistance to blast must be demonstrated either by design calculations or tests on prototype door assemblies.

Submit data on standard blast doors consisting of catalog cuts, brochures, circulars, specifications, calculations, and product data that show complete dimensions and completely describe overpressure ratings, rebound ratings, doors, frames, anchors, hardware, and accessories. Submit manufacturers' instructions for installation and field testing. Submit information, for door description, bound in manual form consisting of manufacturer's safety precautions, preventative maintenance and schedules, troubleshooting procedures, special tools, parts list, and spare parts data. All material must be cross referenced to the door designations shown on the drawings.

### 1.2.1 Design Requirements

The design must be in accordance with the explosives safety requirements of **DOD 6055.09-M** and the protective construction requirements of **UFC 3-340-02**.

#### 1.2.1.1 Static Material Strength

Obtain the static values for minimum yield strength (or yield point) and (ultimate) tensile strength for steel from the applicable material specification. For tensile strength specified in terms of a tensile strength range, the lowest tensile strength specified must be selected for design. Structural steel having a minimum static yield strength (or yield point) of 50 ksi or less [and Grade 60 reinforcing bars] must be designed using an average yield strength computed as 1.1 times the minimum static yield strength or yield point. If the minimum static yield strength for structural steel exceeds 50 ksi, the expected yield strength used for design must be equal to the minimum specified static yield strength or yield point without increase. [The in-place compressive strength of concrete used for design must be the specified compressive strength.]

#### 1.2.1.2 Dynamic Material Strength

Compute the dynamic material strength by applying a dynamic increase factor that accounts for the increase in material strength due to strain rate effects. Appropriate material-specific dynamic increase factors can be found in **UFC 3-340-02** for use in design.

#### 1.2.1.3 Structural Member Design

[Obtain structural steel section properties for rolled shapes from **AISC 325**, or steel manufacturers' catalogs. ] [Nominal reinforcing bar designations, weights, and dimensions must be obtained from **ACI 318M**, **ACI 318**, or the reinforcing bar specification. ] Design structural members [,to include reinforced concrete members] in accordance with **UFC 3-340-02** and satisfy all applicable response limits.



### 1.2.2 Blast Effects

#### 1.2.2.1 Overpressure

Overpressure to be resisted must be [\_\_\_\_\_] psi [with a [\_\_\_\_\_] millisecond duration] in the seating direction. The spatial distribution of overpressure must be uniform unless otherwise specified or indicated. [For overpressure specified or indicated with duration only, the waveform must be a triangle with a zero rise time.] [Special waveforms are indicated.]

#### 1.2.2.2 Overpressure Direction

For overpressure identified as seating and for overpressure directions not otherwise specified or indicated, the positive phase overpressure must be in the direction that causes the door to seat toward the frame.

#### 1.2.2.3 Fragment Resistance

Per the physical security requirements of [DOD 5100.76-M](#), the door must be designed for fragment and ballistic resistance. Accordingly, both the door and the door and frame interface must be designed to prevent fragment or ballistic perforation in accordance with [DOD 5100.76-M](#).

#### 1.2.3 Rebound

The explosives safety requirements of [DOD 6055.09-M](#) are based on a single explosives detonation in an adjacent ECM of its sited net explosives weight limit. [DOD 6055.09-M](#) does not require protection from multiple detonations or address physical security requirements that may apply after an accidental detonation. Accordingly, rebound resistance is not specifically required by [DOD 6055.09-M](#). However, per [DOD 5100.76-M](#), rebound resistance may be a physical security requirement and must be addressed accordingly.

#### 1.2.4 Blast Door Operation

Measure the force required to set the door in motion from the 90-degree open position, and measure the force required to engage and release the latches at the latch handle with the door in the normal closed position.

Maximum operating forces must be [30] [40] [100] [\_\_\_\_\_] lbf to set the door in motion and [20] [50] [\_\_\_\_\_] lbf to [swing] [slide] the door. Maximum force to engage and release latches must be [20] [30] [\_\_\_\_\_] lbf. [Operating forces must conform to [NFPA 101](#).]

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

#### SD-02 Shop Drawings

Blast Resistant Door; G[, [\_\_\_\_\_] ]

Trolley Track; G[, [\_\_\_\_\_] ]

#### Trolleys; G[, [\_\_\_\_]]

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

#### SD-03 Product Data

#### Trolleys; G[, [\_\_\_\_]]

#### SD-05 Design Data

#### Manual Operator; G[, [\_\_\_\_]]

Submit calculations showing that manual operator has achieved by mechanical advantage, a required downward force to open the doors of not more than 18 pounds.

#### SD-10 Operation and Maintenance Data

#### Blast Resistant Door; G[, [\_\_\_\_]]

### 1.4 QUALITY ASSURANCES

Welders, welding operators, and weld inspectors must be qualified in accordance with AWS D1.1/D1.1M [except that] [welders performing arc welding of steel sheet and strip must be qualified in accordance with AWS D1.3/D1.3M].

### 1.5 DELIVERY, STORAGE, AND PROTECTION

Protection from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather, dust, and contaminants. Remove and replace damaged items with new items.

### 1.6 WARRANTY

Furnish manufacturer's written warranty covering the blast door assembly for 2 years after acceptance by the Government. Warranty must provide for repair and replacement of the blast door assembly and individual hardware and accessory items in the event of malfunction due to defects in design, materials, and workmanship except that the warranty need not cover finishes provided by others.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Only structural steel materials, for which tension properties have been obtained, may be used to resist blast. Select steel used in the door, door frame, and door frame anchors, and non stainless steel fasteners that resist blast, from the materials specified.

Submit structural analysis and design calculations demonstrating resistance to blast when blast resistance is not demonstrated by prototype tests. Design calculations must demonstrate adequacy under the blast effects specified or indicated. Include in the design calculations a sketch of the overpressure waveform; dimensioned sketches of blast resisting elements

such as door members, frame members, latches, and hinges; section properties for blast resisting members including built-up sections; the standard under which steel is produced; static and dynamic material strength properties; the resistance, stiffness, mass, elastic natural period, and elastic deflection for flexural members; and the peak deflection, peak support rotation, and time to peak deflection for door members in flexure. Design calculations must cover initial response and all secondary items such as shear, welds, local buckling, web crippling, hinges, and latches.

#### 2.1.1 Structural Steel

Structural steel bars, plates, and shapes must conform to [ASTM A36/A36M](#), [ASTM A242/A242M](#), [ASTM A529/A529M](#), [ASTM A572/A572M](#), [ASTM A588/A588M](#), or [ASTM A992/A992M](#). Quenched and tempered steel plate must conform to [ASTM A514/A514M](#).

Submit steel mill reports covering the number, chemical composition, and tension properties for structural quality steels. When blast resistance is demonstrated by calculations, a certificate stating that the door assembly provided was manufactured using the same materials, dimensions, and tolerances shown in the calculations. When blast resistance is demonstrated by prototype testing, a certificate stating that door and frame provided was manufactured using the same materials, dimensions, and tolerances as the tested prototype and listing the hardware and frame anchors required to achieve blast resistance. Each certificate must be signed by an official authorized to certify in behalf of the manufacturer and must identify the door assembly and date of shipment or delivery to which the certificate applies.

#### 2.1.2 Structural Tubing

Structural tubing must conform to [ASTM A500/A500M](#), [ASTM A501/A501M](#), or [ASTM A618/A618M](#).

#### 2.1.3 Concrete and Concrete Reinforcement

Concrete is specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Concrete reinforcement must conform to [ASTM A615/A615M](#) or [ASTM A706/A706M](#), Grade 60.

#### 2.1.4 Bolts, Nuts, and Washers

##### 2.1.4.1 Bolts

The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

- a. Anchor Bolts: [ASTM A307](#), Grade A.
- b. High Strength Bolts: [ASTM A325](#), Type 1 or 2.
- c. High Strength Bolts: [ASTM A490](#)

##### 2.1.4.2 Nuts

[ASTM A563](#), Grade A, heavy hex style, except nuts under 1.5 inches may be provided in hex style.

#### 2.1.4.3 Washers

ASTM F844 washers for ASTM A307 bolts, and ASTM F436 washers for ASTM A325 bolts.

#### 2.1.5 Welding Electrodes and Rods

AWS D1.1/D1.1M.

### 2.2 HARDWARE

#### 2.2.1 Trolleys

Must consist of cast steel or forged steel components and be designed to operate from the track beam section furnished under this contract. Trolley wheels must be made from high alloy forged steel. The wheel tread must be accurately machined to assure concentricity of axle and tread and hardened to 425-480 Brinell. Wheel treads must be unpainted. Wheel axles must be precision machined from high alloy, heat treated steel. Minimum Rated Load Capacity of the trolley must be 3,000 lbs, but not less than the load required for door operation.

##### 2.2.1.1 Manual Operator

Provide a cast steel or forged steel, galvanized, pull door travel chain operating over a sprocket. Extend chain loop to within 3 feet of the floor. Provide chain cleat and pin for securing pull door travel chain. Provide mechanical advantage by means of roller chain and sprocket drive and/or gearing. The downward force required to operate the door must not exceed 18 pounds.

##### 2.2.1.2 Trolley Track

Provide as indicated on drawings.

#### 2.2.2 Hinges

##### 2.2.2.1 General Requirements

Hinges must be specially manufactured to support the door and to resist blast induced loading. [The number and placement of hinges must be as shown on the structural drawings.] [The number of hinges must be determined by the blast door manufacturer.] Welds used in hinges must be continuous. Attach hinges to the door and frame using mechanical fasteners, except that full surface hinges for doors with locks must be attached to the door and frame by welding or approved tamper-resistant mechanical fasteners and hinges for doors with locks must have approved nonremovable pins. Load ratings and fatigue life for ball and roller bearings must be determined in accordance with ABMA 9 and ABMA 1111 as applicable and, unless otherwise approved, the bearing steel must conform ASTM A534. Hinges must be capable of operating for the minimum number of cycles specified without failure or excessive wear under the door service loads where one cycle consists of swinging the door back and forth between the normal closed position and the 90-degree open position, where failure or excessive wear means that the latches do not seat properly or the door does not swing smoothly due to hinge failure or wear, and where door service loads consist of the door weight plus any loads produced by hardware. Rolling bearings must be factory grease lubricated and either sealed or provided with easily accessible lubrication fittings.

#### 2.2.2.2 Hinge Description

[Hinge Type 1 must be capable of smooth operation for a minimum of 250,000 cycles. This type of hinge must be provided with structural quality steel [pins and leafs and either rolling bearings in both the thrust and radial directions or hardened steel washer (disc) thrust bearings and rolling radial bearings].] [Hinge Type 2 must be smooth operating and must be provided with structural quality steel pins and leafs, steel base washer (disc) thrust bearings, and metallic journal radial bearings or other approved non rolling type bearings.] [Hinge Type 3 must be provided with metallic bearings.] All hinges must conform to approved design drawings.

#### 2.2.3 Locking System

##### 2.2.3.1 Latching Points

The number and placement of latching points must be [as shown on the structural drawings] [determined by the door manufacturer].

[For multiple latching points, latching points can be provided at the head, sill, and jambs.] [For jamb latching points, latching points must be provided at the jambs only.]

##### 2.2.3.2 Locking System Operation

Locking systems must be capable of operating for the same number of cycles specified for the door hinges where one latch operating cycle consists of engaging and releasing using the handle. Latches must remain engaged until manually released and must not release under blast loads. [Manually operated latches must remain in the released position until manually engaged.] [Self-latching latches must provide self-activating engagement when the door is swung to the normal closed position.] Handles must release latches under a clockwise motion.

##### 2.2.3.3 Latching Mechanism

[Latching mechanisms and latches for structural steel doors must be mounted on the seating face of the door.] [Unless otherwise approved, latch handle axles (spindles) for [structural steel doors] must extend through the blast load carrying portion of the door and must be provided with suitable metallic journal bearings.] Latch handle axles must be manufactured of hardened steel or stainless steel, and axles requiring lubrication must be provided with easily accessible lubrication fittings.

##### 2.2.3.4 Safety Cover

Safety covers must consist of steel housings that enclose the latching mechanism such that only the operating rods are exposed.

##### 2.2.3.5 Cover Plate

Cover plates for structural steel doors must be manufactured of minimum 1/4 inch thick plate and must enclose the entire latching mechanism.

##### 2.2.3.6 Latches

Latches (latch bolts) must be manufactured of structural steel and the latch bolt throw must not be less than 3/4 inch. Latch bolts must be the

sliding type in which the latch bolt slides into a matching strike in the door frame [or the lever type in which the latch bolt rotates into a groove in the frame as specified or indicated] [except that latches for doors with [mortise lock and latch sets] [and] [exit devices] must be the sliding type]. Manually operated latches must draw the door toward the frame during latching.

Submit shop and field operating test reports that include values for opening and closing forces and times, forces required to operate latches, and a description of all operating tests performed.

#### 2.2.3.7 Handle

[Handles for doors with mortise lock and latch sets must be manufactured of [steel castings] [or] [stainless steel].] Latch handles must be firmly fastened to axles. Lever handles must be perpendicular to the door edge when latches are engaged. [Single lever handles must be located at the stile opposite the hinges.] [[Wheel] [and spoke lever] [Spoke lever] handles must be located approximately halfway between the stiles.]

#### 2.2.4 Keying

[Keying must conform to Section 08 71 00 DOOR HARDWARE.] [Change keys for locks must be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Unless otherwise specified, two change keys must be provided for each lock.] [Locks must be furnished with the manufacturer's standard construction key system.]

#### 2.2.5 Straight Steel Bar Door Pull

Straight steel bar door pulls must be manufactured of round steel bar. The type furnished must be [Type I: 1/2 inch diameter, 5 inch grip and 2-1/2 inch projection with 1/2 inch inside bend radiuses] [;] [and] [Type II: 5/8 inch diameter, 12 inch grip and 4 inch projection with 15/16 inch inside bend radiuses] [; and] [Type III: 5/8 inch diameter, 8 inch grip and 4 inch projection with 15/16 inch inside bend radiuses]. Grip and projection dimensions are measured from the bar centerline. The pull must be attached to the door by fillet weld all around.

#### 2.2.6 Shrouded Padlock

High security padlocks with shrouded shackles must conform to MIL-DTL-43607.

#### 2.2.7 High Security Hasp

High security hasps must be [shrouded] [unshrouded] and must conform to MIL-DTL-29181.

#### 2.2.8 Internal Locking Device

For locking mechanism requirements, refer to DOD 5100.76-M. Internal Locking Devices must be provided by a competent manufacturer. Unique keys must be provided with each ILD. [ILD must be integrated with electronic monitoring and access control systems.] [\_\_\_\_\_]

#### 2.2.9 Door Stop

Door stops must be designed to resist the impact of the door. The stop must not scratch or scar the door finish when the door is opened against

the stop.

#### 2.2.10 Overhead Door Holder

Overhead door holder must be surface mounted. The holder must have a spring or other device to cushion the door action and must limit the door swing at [85] [110] degrees. [The holder must have a built-in, hold-open capability at the swing limit specified.]

#### 2.2.11 Gasket Seal

Sealed doors must have the full door perimeter and all door penetrations sealed. Perimeter seals must be the rubber gasket type. Gaskets must be removable, capable of sealing the mating surfaces, and resistant to the atmospheric environment. One spare set of gasket seals must be provided for each door assembly for which gasket seals are specified.

#### 2.2.12 Door Silencer

Rubber door silencers must cushion the impact of the door against the frame so that steel-to-steel contact is not made during closing.

#### 2.2.13 Intrusion Detection System

Where required, as specified in [DOD 5100.76-M](#), provide either an approved DOD Component standardized system, a DOD Component commercial equivalent, or an integrated system.

### 2.3 ACCESSORIES

#### 2.3.1 Removable Threshold

The sill must be flush with the adjacent floor when the threshold is removed. The removable threshold must be attached using approved countersunk mechanical fasteners.

#### 2.3.2 Ramp

The ramp must be structural steel, portable, and weigh not more than [200] [\_\_\_\_\_] pounds. The ramp must be of sufficient length to extend the full door opening width and must have the profile indicated. The ramp must be capable of supporting [a wheel load of [\_\_\_\_\_] lbf] [the wheel load indicated].

#### 2.3.3 Weatherstripping

Weatherstripping seals must be 2 inch wide rubber impregnated canvas belting at head and jambs of doorway. The material must have a minimum thickness of 3/16 inch and must be attached to structure with a continuous 1/8 inch by 1-1/4 inch metal strip and 1/4 inch by 3/4 inch metal screws at 8 inches on center.

#### 2.3.4 Locking Bars, Restraining Bracket, Chain Guide Holder and Handle

Provide as indicated on drawings.

#### 2.3.5 Nameplate

Each door assembly must have a permanently affixed nameplate that displays

the manufacturer's name, place and year of manufacture, and the applicable peak overpressure, impulse, and rebound rating.

## 2.4 FABRICATION

Fabricate doors in accordance with the applicable provisions of [AISC 360](#). Workmanship must be equal to standard commercial practice in modern metal shops. Fabricate and assemble in the shop to the greatest extent possible.

Submit detailed fabrication and assembly drawings for doors not conforming to those included in [DDESB Technical Paper 15](#) or for doors that are included but with appreciable modifications, indicating the location and showing dimensions, materials, fabrication methods, hardware, and accessories in sufficient detail to enable the Contracting Officer to check compliance with contract documents. These drawings need not be submitted for standard doors for which manufacturer's catalog data is submitted. Weld symbols used must conform to [AWS A2.4](#).

Submit blast analyses and design calculations for any blast door frame or supporting reinforced concrete section that either is not listed as approved for new construction in Technical Paper 15 or does not conform to the approved Technical Paper 15 drawings for the door selected.

### 2.4.1 Shop Assembly

Welding must be in accordance with [AWS D1.1/D1.1M](#) except that arc welding of steel sheet and strip must be in accordance with [AWS D1.3/D1.3M](#). For the doors, welding might cause significant residual stresses; therefore, Contractor must submit for approval by the Contracting Officer a detailed sequence of the welding, augmenting the requirements given by the AWS specifications. [Stainless steel must be welded using electrodes conforming to [AWS A5.4/A5.4M](#)] Fabricated steel must be well-formed to shape and size, with sharp lines and angles. Intermediate and corner joints must be coped or mitered. Exposed welds must be dressed smooth. [The stiles [and top] of built-up structural steel doors must be closed using channel shapes or plates.] [When feasible, faceplates for structural steel doors must be one piece. When one-piece faceplates are not feasible, plates must be joined using full penetration groove weld butt joints or other approved welds.]

### 2.4.2 Shop Finishing

[Shop priming of steel surfaces must conform to Section [09 90 00 PAINTS AND COATINGS](#), except that surfaces that will be embedded in concrete need not be primed]. [Galvanizing of doors and frames must conform to [ASTM A123/A123M](#) or other approved methods. Surfaces that will be embedded in concrete need not be galvanized. Galvanizing of exposed portions of concrete anchors, non stainless steel fasteners, and hardware other than factory finished hardware must conform to [ASTM A153/A153M](#) or other approved methods.] All exposed surfaces must be primed and interior surfaces coated with an approved rust inhibitor.

### 2.4.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to [ASTM A780/A780M](#) or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the Contracting Officer. Clean areas to be repaired and remove the slag from the welds. Heat surfaces in which stick or paste material is applied, with



a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.

#### 2.4.4 Painting

The blast resistant door assembly must be shop painted in accordance with Section 09 90 00 PAINTS AND COATINGS.

#### 2.4.5 Clearance

[Trolley, trolley track, and blast door] [Hinge, frame, and blast door] must be designed together as a system to operate properly within the vertical and horizontal space provided. [The clearance between the seated steel surfaces of structural steel doors and frames must not exceed 1/16 inch.] [The lateral clearance between flush mounted structural steel doors and frames must not exceed [1/4] [\_\_\_\_\_] inch at the head and jambs and the clearance between the meeting edges of pairs of doors must not exceed [1/2] [\_\_\_\_\_] inch.] The clearance between the door bottom and threshold must not exceed 3/4 inch.

#### 2.4.6 Door Support System

Provide track clamps, threaded suspension rods, support brackets, hinge support plates, and door frame stiffeners as shown on the drawings such that the assembly is capable of supporting 150 percent of the design door loads.

### PART 3 EXECUTION

#### 3.1 ERECTION

##### 3.1.1 Procedure

Erect in accordance with the manufacturer's written instructions, AISC 360, and ACI 318. Use erecting equipment suitable for the work and in first class condition. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, report such condition immediately to the Contracting Officer and obtain approval of the method of correction; make the correction in his presence. The straightening of plates and angles or other shapes must be done by the methods approved by the Contracting Officer. If heating of metal is approved for straightening, it must not be to a higher temperature than that producing a dark "cherry red" color. After heating, the metal must be cooled as slowly as possible. Evidence of fracture on the surface of the metal after straightening is not allowed. Drain steelwork properly; fill pockets exposed to the weather with an approved waterproof material.

##### 3.1.2 Connections

Provide anchor bolts and other connections between the steel and concrete and properly locate and build into connecting work. Design connections for which details are not indicated in accordance with AISC 360 and UFC 3-340-02.

##### 3.1.3 High-Strength Bolting

Specification for structural joints using ASTM A325 bolts, approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering

Foundation must govern the furnishing and installation of high-strength bolting, with the following modifications. Alternate fasteners, specified in paragraph 2(d) will not be permitted.

#### 3.1.4 Erection Tolerances

[Steel construction must be in accordance with AISC 303.] [Concrete construction tolerances must be in accordance with ACI 301.]

#### 3.1.5 Temporary Welds and Backing Strips

Temporary Welds and Backing Strips must be removed.

### 3.2 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit shop and field operating test reports that include values for opening and closing forces and times, forces required to operate latches, and a description of all operating tests performed.

#### 3.2.1 Inspection

The manufacturer of the doors must provide a field inspection engineer to perform the following:

- a. Check installation of embedded items before pouring of concrete (after forms or shoring are in place) to insure that the dimensional tolerances recommended by door manufacturer have been complied with.
- b. Re-check embedded items to verify the accuracy of dimensions after shoring and forms are removed from concrete.
- c. Supervise any necessary corrective action.
- d. Supervise the job site assembly and installation of the doors and operators.
- e. Inspect final assembly of doors and operators after corrections and adjustments have been made to doors.
- f. Demonstrate to the Contracting Officer that operation of the door assembly is as specified.

#### 3.2.2 Visual Inspection of Welding

Visually inspect welding while the operators are making the welds and again after the work is completed. After the welding is completed, hand or power wire brush welds and thoroughly clean them before the inspector makes the check inspection. Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slab inclusions; excessive roughness, unfilled craters, gas pockets, undercuts, overlaps, size and insufficient throat and concavity. Inspect the preparation of groove welds for adequate throat opening and for snug position of back-up-bars.

#### 3.2.3 Nondestructive Testing

AWS D1.1/D1.1M. Test locations must be [as indicated] [selected by the Contracting Officer]. If more than [20] [\_\_\_\_\_] percent of welds made by a welder contain defects identified by testing, then all welds made by that welder must be tested by radiographic or ultrasonic testing, as approved by

the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing must be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

Testing frequency: Provide the following types and number of tests:

<u>Test Type</u>	<u>Number of Tests</u>
Radiographic	[_____]
Ultrasonic	[_____]
Magnetic Particle	[_____]
Dye Penetrant	[_____]

Any weld repairs required must be in accordance with [AWS D1.1/D1.1M](#).

3.2.4 Operational Tests

After installation is completed, field test each door for operation, clearance, fit, and seating by operating the door and hardware through at least 10 operating cycles. Test door and hardware operation using the forces specified. Provide personnel and equipment required to perform field testing. Unless waived, perform all field tests in the presence of the Contracting Officer. After testing is completed, prepare test reports and furnish [three] [\_\_\_\_\_] copies.

3.2.5 Prototype Static Test

Static tests on prototype door assemblies must demonstrate that the door will resist the blast overpressure. Static tests will be accepted only if the door and frame proposed are manufactured using the same materials, dimensions, and tolerances as those in the prototype static test and the static overpressure used in the test is at least two times the blast overpressure. Static test reports must be supplemented with calculations that demonstrate rebound resistance when rebound resistance is required and is not tested.

3.2.6 Prototype Blast Test

Blast tests on the prototype door assembly must demonstrate that the door will resist the overpressure waveform. Blast tests will be accepted only if the door and frame proposed are manufactured using the same materials, dimensions, and tolerances as those in the prototype blast tests. The rise time of the test waveform must be zero or subject to approval. The overpressure waveform used in the test must exceed the overpressure waveform in both peak overpressure and impulse, and the blast test report must be supplemented with calculations that demonstrate the required rebound resistance is met. Submit certified test reports demonstrating blast resistance. Include in the test reports the name and location of the testing agency or laboratory, a description of the testing apparatus, the date of the tests, a description of the door specimen tested, descriptions of loadings, the value of measured peak door deflection and peak permanent set and analysis and interpretation of test results.

-- End of Section --



## SECTION 08 39 54

## BLAST RESISTANT DOORS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9 (2015) Load Ratings and Fatigue Life for Ball Bearings

ABMA 11 (2014) Load Ratings and Fatigue Life for Roller Bearings

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2017) Steel Construction Manual

AISC 360 (2016) Specification for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members

## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A5.4/A5.4M (2012) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A242/A242M	(2013; R 2018) Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A354	(2017; E 2017; E 2018) Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501/A501M	(2021) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A514/A514M	(2018) Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A529/A529M	(2019) Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A534	(2017; R 2022) Standard Specification for Carburizing Steels for Anti-Friction Bearings

ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A574	(2021) Standard Specification for Alloy Steel Socket-Head Cap Screws
ASTM A588/A588M	(2019) Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A606/A606M	(2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A618/A618M	(2021) Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM F436	(2011) Hardened Steel Washers

ASTM F835	(2020) Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws
ASTM F883	(2013; R 2022) Standard Performance Specification for Padlocks
ASTM F2155	(2001; R 2017) Standard Specification for Performance of Hasps and Other Attachment Devices for Padlocks of Seals

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.3	(2020) Exit Devices
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.20	(2021) Strap and Tee Hinges, and Hasps

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 898-1	(2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel – Part 1: Bolts, Screws and Studs with Specified Property Classes – Coarse Thread and Fine Pitch Thread
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 80A	(2022) Recommended Practice for Protection of Buildings from Exterior Fire Exposures
NFPA 101	(2021) Life Safety Code
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

## U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA Lock	DOD Lock Program; <a href="http://www.dscp.dla.mil/gi/locks/">http://www.dscp.dla.mil/gi/locks/</a>
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## 1.2 SYSTEM DESCRIPTION

Provide a blast resistant door which fits a [Door Description](#) as follows: [Structural steel doors shall be [flush mounted in frames] [or] [surface mounted] [as indicated].] [Reinforced concrete doors shall be surface mounted.] [Hollow metal doors shall be flush mounted in frames.] Doors shall be the manually operated, side hinged, swinging type. Each door assembly shall include the door, frame, anchors, hardware, and accessories and shall be provided by a single manufacturer. Frames and anchors shall



be capable of transferring blast and rebound reactions to the adjacent supporting structure. Resistance to blast shall be demonstrated either by design calculations or tests on prototype door assemblies.

### 1.2.1 Design Requirements

#### 1.2.1.1 Static Material Strength

Obtain the static values for minimum yield strength (or yield point) and (ultimate) tensile strength for steel from the applicable material specification. For tensile strength specified in terms of a tensile strength range, the lowest tensile strength specified shall be selected for design. Structural steel having a minimum static yield strength (or yield point) less than 50 ksi [and Grade 60 reinforcing bars] shall be designed using an average yield strength computed as 1.1 times the minimum static yield strength or yield point. If the minimum static yield for structural steel exceeds 50 ksi, the expected yield strength used for design shall be equal to the minimum specified static yield strength or yield point without increase. [The in-place compressive strength of concrete used for design shall be computed by multiplying the specified compressive strength by 1.1 to reach the expected compressed strength and then multiplying by not more than 1.15 to account for a one year age effect.] [The expected yield stress for steel sheet and strip used in design shall be computed as 1.21 times the specified static yield point.]

#### 1.2.1.2 Dynamic Material Strength

Compute the dynamic material strength by applying a dynamic increase factor that accounts for the increase in material strength due to strain rate effects. The dynamic increase factor for structural steel in flexure shall be applied to the average yield strength and shall be [1.29] [\_\_\_\_], [1.19] [\_\_\_\_], and [1.09] [\_\_\_\_] for structural steel having a minimum yield strength (or yield point) of 36, 50, and 100 ksi, respectively. The dynamic increase factor for structural steel having a minimum yield strength (or yield point) between these values shall be obtained by interpolation. Optionally, for structural steel in these yield ranges, the dynamic increase factor shall be determined by a detailed analysis that accounts for the time to yield. The dynamic increase factor for structural steel having a minimum yield exceeding 100 ksi shall be 1.0. [The dynamic increase factor for Grade 60 flexural reinforcing bars shall be [1.17] [\_\_\_\_] applied to the average yield strength. The dynamic increase factor for concrete used in flexure shall be [1.19] [\_\_\_\_] applied to the in-place compressive strength. Optionally, the dynamic increase factor applied to flexural reinforcing bar yield and concrete compressive strength shall be determined by a detailed analysis that accounts for the time to steel yield and time to ultimate concrete strength.] [The dynamic increase factor for steel sheet and strip used in flexure shall be 1.1 applied to the average yield stress.]

#### 1.2.1.3 Structural Member Design

[Obtain structural steel section properties for rolled shapes from AISC 325, AISC 325, or steel manufacturers' catalogs. The plastic moment capacity for single plate sections and sections built up from plates and shapes shall be computed as the average of the elastic and plastic section modulus multiplied by the dynamic yield strength, unless otherwise approved. Shear, welds, local buckling, and web crippling of structural steel shall be designed in accordance with AISC 325, the plastic design provisions of AISC 360, or by other approved methods except that for blast design, the

load factors and resistance factors shall be equal to 1.0 and the dynamic yield strength shall be substituted for the static yield stress.] [Nominal reinforcing bar designations, weights, and dimensions shall be obtained from ACI 318 or the reinforcing bar specification. The moment of inertia of the reinforced concrete cross section used to determine the elastic deflection shall be the average of the moment of inertia of the gross section and the moment of inertia of the cracked section. The resistance of the reinforced concrete section shall be computed in accordance with ACI 318 or other approved methods except that for blast design, the load and resistance factors shall be equal to 1.0 and the dynamic reinforcing bar yield strength and dynamic ultimate concrete strength shall be substituted for the static strength values.] [Hollow metal doors shall be designed in accordance with AISI S100 except that for blast design, the dynamic yield strength shall be substituted for the static yield point.]

#### 1.2.1.4 Dynamic Analysis and Deformation

Design the door using an equivalent single degree of freedom or other approved dynamic analysis method. The maximum door deformation shall be selected by the door manufacturer except that the maximum deformation in flexure shall not exceed the deformation limits specified or indicated. The deformation of structural steel members having a minimum yield strength or yield point greater than 65 ksi shall not exceed the elastic deflection. [Increased resistance due to strain hardening of structural steel in flexure can be used when the ductility ratio exceeds 10 or when otherwise approved.] [The ductility ratio for flexural members in hollow metal doors shall not exceed 1.0.]

#### 1.2.1.5 Rebound Resistance

Rebound resistance shall be the specified or indicated percentage of the door resistance at initial peak response.

#### 1.2.2 Blast Effects

##### 1.2.2.1 Overpressure

The spatial distribution of overpressure shall be uniform unless otherwise specified or indicated. [For overpressure specified or indicated without duration, the overpressure waveform shall have a zero rise time and infinite duration.] [For overpressure specified or indicated with duration only, the waveform shall be a triangle with a zero rise time.] [Special waveforms are indicated.]

##### 1.2.2.2 Overpressure Direction

[For overpressure identified as seating and for overpressure directions not otherwise specified or indicated, the positive phase overpressure shall be in the direction that causes the door to seat toward the frame.] [For overpressure identified as unseating, the positive phase overpressure shall be in the direction that causes the door to unseat away from the frame.]

##### 1.2.2.3 Fragment Resistance

For doors specified or indicated to resist fragments, design the door and the door and frame interface to prevent fragment perforation and the latches and latching mechanism shall be shielded from fragment damage. The fragment impact point shall be anywhere on the door and frame face exposed to overpressure.

### 1.2.3 Blast Door Operation

Measure the force required to set the door in motion from the 90-degree open position, and measure the force required to engage and release the latches at the latch handle with the door in the normal closed position.

### 1.2.4 Other Submittals Requirements

The following shall be submitted:

- a. Detailed fabrication and assembly drawings for special doors or standard doors with appreciable modifications, indicating the door location and showing dimensions, materials, fabrication methods, hardware, and accessories in sufficient detail to enable the Contracting Officer to check compliance with contract documents. These drawings need not be submitted for standard doors for which manufacturer's catalog data is submitted. Weld symbols used shall conform to [AWS A2.4](#).
- b. Data on standard blast doors consisting of catalog cuts, brochures, circulars, specifications, and product data that show complete dimensions and completely describe overpressure ratings, rebound ratings, doors, frames, anchors, hardware, and accessories. Manufacturer's instructions for installation and field testing.
- c. Detailed structural analysis and design calculations demonstrating resistance to blast when blast resistance is not demonstrated by prototype tests. Design calculations shall demonstrate adequacy under the blast effects specified or indicated. Include in the design calculations a sketch of the overpressure waveform; dimensioned sketches of blast resisting elements such as door members, frame members, latches, and hinges; section properties for blast resisting members including built-up sections; the standard under which steel is produced; static and dynamic material strength properties; the resistance, stiffness, mass, elastic natural period, and elastic deflection for flexural members; and the peak deflection, peak support rotation, and time to peak deflection for door members in flexure. Design calculations shall cover initial response, rebound, and all secondary items such as shear, welds, local buckling, web crippling, hinges, and latches.
- d. Steel mill reports covering the number, chemical composition, and tension properties for structural quality steels. When blast resistance is demonstrated by calculations, a certificate stating that the door assembly provided was manufactured using the same materials, dimensions, and tolerances shown in the calculations. When blast resistance is demonstrated by prototype testing, a certificate stating that door and frame provided was manufactured using the same materials, dimensions, and tolerances as the tested prototype and listing the hardware and frame anchors required to achieve blast resistance. Each certificate shall be signed by an official authorized to certify in behalf of the manufacturer and shall identify the door assembly and date of shipment or delivery to which the certificate applies.
- e. Information, for DOOR DESCRIPTION, bound in manual form consisting of manufacturer's safety precautions, preventative maintenance and schedules, troubleshooting procedures, special tools, parts list, and spare parts data. All material shall be cross referenced to the door

designations shown on the drawings.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Installation; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Door Description; G[, [\_\_\_\_\_]]  
Design Requirements; G[, [\_\_\_\_\_]]  
Manufacturer's Field Service

#### SD-06 Test Reports

Tests  
Tests, Inspections, and Verifications  
Fire Rating Test and Inspection  
Prototype Static Test; G[, [\_\_\_\_\_]]  
Prototype Blast Test; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Materials  
Fire-Rated Door Assemblies  
Thermal Insulation  
Sound Rating Test

#### SD-10 Operation and Maintenance Data

Door Description; G[, [\_\_\_\_\_]]

### 1.4 QUALITY ASSURANCE

Welders, welding operators, and weld inspectors shall be qualified in accordance with AWS D1.1/D1.1M [except that] [welders performing arc welding of steel sheet and strip shall be qualified in accordance with AWS D1.3/D1.3M] [and] [welders and weld operators performing welding of reinforcing bars shall be qualified in accordance with AWS D1.4/D1.4M].

### 1.5 DELIVERY, STORAGE, AND HANDLING

Store door assemblies, delivered and placed in storage, with protection from weather and dirt, dust, and contaminants.

### 1.6 WARRANTY

Furnish manufacturer's written warranty covering the blast door assembly for 2 years after acceptance by the Government. Warranty shall provide for repair and replacement of the blast door assembly and individual hardware and accessory items in the event of malfunction due to defects in design,

materials, and workmanship except that the warranty need not cover finishes provided by others.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Only structural quality steel materials, for which tension properties have been obtained, shall be used to resist blast except that commercial quality steel sheet and strip shall be permitted for prototype tested hollow metal doors. Select steel used in the door, door frame, and door frame anchors, and non stainless steel fasteners that resist blast, from the materials specified.

#### 2.1.1 Concrete and Concrete Reinforcement

Concrete is specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Concrete reinforcement shall conform to ASTM A615/A615M or ASTM A706/A706M, Grade 60.

#### 2.1.2 Structural Tubing

Structural tubing shall conform to ASTM A500/A500M, ASTM A501/A501M, or ASTM A618/A618M.

#### 2.1.3 Structural Steel

Structural steel bars, plates, and shapes shall conform to ASTM A36/A36M, ASTM A242/A242M, ASTM A529/A529M, ASTM A572/A572M, or ASTM A588/A588M. Quenched and tempered steel plate shall conform to ASTM A514/A514M.

#### 2.1.4 Steel Sheet and Strip

Steel sheet and strip shall conform to ASTM A653/A653M, Type A, B, and C; ASTM A653/A653M; ASTM A606/A606M; or ASTM A792/A792M, Grades 33, 37, 40, and 50.

#### 2.1.5 Fasteners

Steel studs and bolts shall conform to ASTM A307, ASTM A325, ASTM A354, ASTM A449, or ASTM A490 as applicable. Steel nuts shall conform to ASTM A563. Hardened circular, beveled, and clipped washers shall conform to ASTM F436. Steel hex cap screws shall conform to ISO 898-1. Steel socket-headed cap screws shall conform to ASTM A574. Steel button and flat-headed countersunk cap screws must conform to ASTM F835.

### 2.2 HARDWARE

#### 2.2.1 Hinges

##### 2.2.1.1 General Requirements

Hinges shall be specially manufactured to support the door and to resist blast induced loading. The number of hinges shall be determined by the blast door manufacturer. Welds used in hinges shall be continuous. Attach hinges to the door and frame using mechanical fasteners, except that full surface hinges for doors with locks shall be attached to the door and frame by welding or approved tamper-resistant mechanical fasteners and hinges for doors with locks shall have approved nonremovable pins. Load ratings and fatigue life for ball and roller bearings shall be determined in accordance

with ABMA 9 and ABMA 11 as applicable and, unless otherwise approved, the bearing steel shall conform to ASTM A534. Hinges shall be capable of operating for the minimum number of cycles specified without failure or excessive wear under the door service loads where one cycle consists of swinging the door back and forth between the normal closed position and the 90-degree open position, where failure or excessive wear means that the latches do not seat properly or the door does not swing smoothly due to hinge failure or wear, and where door service loads consist of the door weight plus any loads produced by hardware. Rolling bearings shall be factory grease lubricated and either sealed or provided with easily accessible lubrication fittings.

#### 2.2.1.2 Hinge Description

[Hinge Type 1 shall be capable of smooth operation for a minimum of 250,000 cycles. This type of hinge shall be provided with structural quality steel pins and leafs and either rolling bearings in both the thrust and radial directions or hardened steel washer (disc) thrust bearings and rolling radial bearings except that rolling thrust bearings and metallic journal radial bearings shall be permitted for hollow metal doors when the specified overpressure is less than 3 psi]. [Hinge Type 2 shall be smooth operating and shall be provided with structural quality steel pins and leafs, steel base washer (disc) thrust bearings, and metallic journal radial bearings or other approved non rolling type bearings.] [Hinge Type 3 shall be provided with metallic bearings.]

#### 2.2.2 Latching System

##### 2.2.2.1 Latching Points

The number of latching points shall be determined by the door manufacturer. [For multiple latching points, latching points can be provided at the head, sill, and jambs.] [For jamb latching points, latching points shall be provided at the jambs only.]

##### 2.2.2.2 Latching System Operation

Latching systems shall be capable of operating for the same number of cycles specified for the door hinges where one latch operating cycle consists of engaging and releasing using the handle. Latches shall remain engaged until manually released and shall not release under blast loads or rebound. [Manually operated latches shall remain in the released position until manually engaged.] [Self-latching latches shall provide self-activating engagement when the door is swung to the normal closed position.] Handles shall release latches under a clockwise motion.

##### 2.2.2.3 Latching Mechanism

[Latching mechanisms and latches for structural steel doors shall be mounted on the seating face of the door.] [Latching mechanisms for hollow metal doors shall be mounted on the seating face of the door and safety covered.] [Unless otherwise approved, latch handle axles (spindles) for [structural steel doors] [and] [reinforced concrete doors] shall extend through the blast load carrying portion of the door and shall be provided with suitable metallic journal bearings.] Latch handle axles shall be manufactured of hardened steel or stainless steel, and axles requiring lubrication shall be provided with easily accessible lubrication fittings.

##### 2.2.2.4 Safety Cover

Safety covers shall consist of steel housings that enclose the latching mechanism such that only the operating rods are exposed.

#### 2.2.2.5 Cover Plate

Cover plates for structural steel doors shall be manufactured of minimum  $1/4$  inch thick plate and shall enclose the entire latching mechanism.

#### 2.2.2.6 Latches

Latches (latch bolts) shall be manufactured of structural quality steel and the latch bolt throw shall not be less than  $3/4$  inch. Latch bolts shall be the sliding type in which the latch bolt slides into a matching strike in the door frame [or the lever type in which the latch bolt rotates into a groove in the frame as specified or indicated] [except that latches for doors with [mortise lock and latch sets] [and] [exit devices] shall be the sliding type]. Manually operated latches shall draw the door toward the frame during latching.

#### 2.2.2.7 Handle

[Handles for doors without locks shall be manufactured of steel castings, forgings, pipe, round tubing, bar, or plate and shall be one piece or have welded joints except that wheel handles can be manufactured of aluminum castings.] [Handles for doors with mortise lock and latch sets shall be manufactured of [steel castings] [or] [stainless steel].] Latch handles shall be firmly fastened to axles. Lever handles shall be perpendicular to the door edge when latches are engaged. [Single lever handles shall be located at the stile opposite the hinges.] [[Wheel] [and spoke lever] [Spoke lever] handles shall be located approximately halfway between the stiles.]

#### 2.2.3 Mortise Lock and Latch Set

Lever handles shall release latches using a torque not exceeding 27 lb-inch. Latches (latch bolts) shall be located at the stiles and operated from a single lever handle. Only one deadbolt shall be provided. The deadbolt shall be manufactured of structural quality steel and the deadbolt throw shall not be less than 1 inch. Mortise locks shall be provided with armored fronts. The function numbers for mortise locks shall be as defined in ANSI/BHMA A156.13.

#### 2.2.4 Keying

[Keying shall conform to Section 08 71 00 DOOR HARDWARE.] [Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Unless otherwise specified, two change keys shall be provided for each lock.] [Locks shall be furnished with the manufacturer's standard construction key system.]

#### 2.2.5 Exit Device

Latches (latch bolts) shall release by depressing the actuation bar using a force of not more than 15 lbf applied perpendicular to the door in the swing direction. The exit device shall [conform to the finish test values specified in ANSI/BHMA A156.3 and shall] be of [stainless steel construction] [and] plain design with straight, beveled, or smoothly rounded sides, corners, and edges. A touch bar may be provided in lieu of

a conventional actuation bar (cross bar). The function numbers for exit devices shall be as defined in [ANSI/BHMA A156.3](#).

#### 2.2.6 Straight Steel Bar Door Pull

Straight steel bar door pulls shall be manufactured of round steel bar. The type furnished shall be [Type I: [1/2 inch](#) diameter, [5 inch](#) grip and [2-1/2 inch](#) projection with [1/2 inch](#) inside bend radiuses] [;] [and] [Type II: [5/8 inch](#) diameter, [12 inch](#) grip and [4 inch](#) projection with [15/16 inch](#) inside bend radiuses] [; and] [Type III: [5/8 inch](#) diameter, [8 inch](#) grip and [4 inch](#) projection with [15/16 inch](#) inside bend radiuses]. Grip and projection dimensions are measured from the bar centerline. The pull shall be attached to the door by fillet welding all around.

#### 2.2.7 Padlock

Low security padlocks shall conform to [ASTM F883](#), Type [PO1][PO2], Option [\_\_\_\_\_] [and] [\_\_\_\_\_] , Grade [\_\_\_\_\_].

#### 2.2.8 Shrouded Padlock

High security padlocks with shrouded shackles shall conform to [DLA Lock](#), 5340-01-217-5068.

#### 2.2.9 Hasp

Low security hasps shall conform to [ANSI/BHMA A156.20](#), Grade [1] [2] [3], steel, [safety] [or] [open hinge] type with [adjustable] [,] [or] [swivel] [,] [or] [fixed] staple, [paint finished] [or] [galvanized] [as specified] and screw fastened to the door and frame.

#### 2.2.10 High Security Hasp

High security hasps shall conform to [ASTM F2155](#), Style [\_\_\_\_\_] [carbon] [corrosion resistant] steel, attached by [fasteners] [welding].

#### 2.2.11 Shrouded Hasp

High security shrouded hasps shall conform to [ASTM F2155](#).

#### 2.2.12 Door Stop

Door stops shall be designed to resist the impact of the door. The stop shall not scratch or scar the door finish when the door is opened against the stop.

#### 2.2.13 Surface Door Closer

The surface door closer shall conform to [ANSI/BHMA A156.4](#). The size and grade shall be selected by the door manufacturer.

#### 2.2.14 Overhead Door Holder

Overhead door holder shall be surface mounted. The holder shall have a spring or other device to cushion the door action and shall limit the door swing at [85] [110] degrees. [The holder shall have a built-in, hold-open capability at the swing limit specified.] [Overhead door holders for hollow metal doors weighing less than [200 pounds](#) shall conform to [ANSI/BHMA A156.8](#).]



### 2.2.15 Gasket Seal

Sealed doors shall have the full door perimeter and all door penetrations sealed. Perimeter seals shall be the rubber gasket type. Gaskets shall be removable, capable of sealing the mating surfaces, and resistant to the atmospheric environment. One spare set of gasket seals shall be provided for each door assembly for which gasket seals are specified.

### 2.2.16 Door Silencer

Rubber door silencers shall cushion the impact of the door against the frame so that steel-to-steel contact is not made during closing.

### 2.2.17 Optical Device

The optical device (spy hole) shall be wide angle and shall not be breeched or dislodged by the specified or indicated blast overpressure. The device shall permit observation from the seating face of the door and shall be located approximately 5 feet above the seating side floor and approximately centered between the stiles.

## 2.3 ACCESSORIES

### 2.3.1 Subframe

At the Contractor's option, a subframe can be provided and built into the structure prior to installation of the frame. The subframe and subframe anchors shall be capable of transferring blast and rebound reactions to the adjacent structure, and the frame shall be capable of transferring these reactions to the subframe. The subframe shall be fabricated in the same manner specified for the frame.

### 2.3.2 Nameplate

Each door assembly shall have a permanently affixed nameplate that displays the manufacturer's name, place and year of manufacture, and the applicable peak overpressure, impulse, and rebound rating.

### 2.3.3 Removable Threshold

The sill shall be flush with the adjacent floor when the threshold is removed. The removable threshold shall be attached using approved countersunk mechanical fasteners.

### 2.3.4 Ramp

The ramp shall be structural steel, portable, and weigh not more than [200] [\_\_\_\_\_] pounds. The ramp shall be of sufficient length to extend the full door opening width and shall have the profile indicated. The ramp shall be capable of supporting [a wheel load of [\_\_\_\_\_] lbf] [the wheel load indicated].

### 2.3.5 Self-Rescue Kit

Self-rescue kits shall contain illustrated instructions, nonadjustable wrenches, screwdrivers, jacks, and all other tools required to open the blast door from the seating face to a width of at least 12 inches. The jack capacity shall not be less than [75,000] [\_\_\_\_\_] lbf. Tools shall be securely mounted in a steel frame using wing nuts or other approved

fasteners. The self-rescue kit frame shall be fabricated in the same manner specified for the door frame and shall be securely anchored to the wall at the location indicated or as directed.

## 2.4 FABRICATION

### 2.4.1 Shop Assembly

Welding shall be in accordance with AWS D1.1/D1.1M except that arc welding of steel sheet and strip shall be in accordance with AWS D1.3/D1.3M and welding of concrete reinforcing bars shall be in accordance with AWS D1.4/D1.4M. [Stainless steel shall be welded using electrodes conforming to AWS A5.4/A5.4M.] [Structural steel doors shall be of welded construction.] Fabricated steel shall be well-formed to shape and size, with sharp lines and angles. Intermediate and corner joints shall be coped or mitered. Exposed welds shall be dressed smooth. [The stiles [and top] of built-up structural steel doors shall be closed using channel shapes or plates.] [When feasible, faceplates for structural steel doors shall be one piece. When one-piece faceplates are not feasible, plates shall be joined using full penetration groove weld butt joints or other approved welds.] [Reinforced concrete doors shall be closed at the edges with structural steel channels or plates and latch housings shall be mortised. Lap splices shall not be used for flexural reinforcing bars.] [Spall plates shall be one piece, covering the entire concrete surface on the seating face of the door, and shall be securely welded to the door edges. Spall plates shall not be less than 1/4 inch thick.] [Faceplated reinforced concrete doors shall be provided with one-piece faceplates on both door faces. Faceplates shall cover the entire concrete surface and shall be securely welded at the door edges. Faceplates shall be not less than 3/8 inch thick.] [Hollow metal door frames shall be pressed steel or structural steel with welded joints. Steel frames or subframes installed in masonry walls shall be provided with adjustable anchors. Hollow metal doors shall be of unitized grid construction with welded grid junctions and shall have flat, one-piece face sheets spot welded to each face of the grid system. The edges of hollow metal doors shall be closed with seams continuously welded. Hollow metal doors shall be neat in appearance, free from warpage and buckle, and suitable reinforcing shall be provided for hardware.]

### 2.4.2 Mullion

Mullions for double doors shall be fabricated in the same manner specified for frames. [Fixed mullions shall be welded to the frame.] [Removable mullions shall be attached to the frame with mechanical fasteners that are accessible for mullion removal or, in lieu of the removable mullion, an astragal shall be provided at the seating face of the inactive door leaf.] Doors shall seat directly against the mullion, and the mullion or astragal shall be capable of transferring the door reactions to the frame.

### 2.4.3 Thermal Insulation

The interior cells between the unitized grid shall be completely filled with thermal insulation material. The U value through the door (panel) shall not exceed [0.24] [\_\_\_\_\_] Btu per square foot per hour per degree F. Submit certification or test report for [thermal insulated] [sound rated] doors listing the type of hardware used to achieve the rating; see paragraph SOUND RATING TEST below.

### 2.4.4 Shop Finishing

[Shop priming of steel surfaces shall conform to Section 09 90 00 PAINTS AND COATINGS, except that surfaces that will be embedded in concrete need not be primed and hollow metal doors shall be either dipped in primer after welding is completed, or exposed surfaces shall be primed and interior surfaces coated with an approved rust inhibitor]. [Galvanizing of doors and frames shall conform to ASTM A123/A123M or other approved methods. Surfaces that will be embedded in concrete need not be galvanized and the interior of hollow metal doors may be treated with an approved rust inhibitor in lieu of galvanizing. Galvanizing of exposed portions of concrete anchors, non stainless steel fasteners, and hardware other than factory finished hardware shall conform to ASTM A153/A153M or other approved methods.]

#### 2.4.5 Clearance

[The clearance between the seated steel surfaces of structural steel doors and frames shall not exceed 1/16 inch.] [The lateral clearance between flush mounted structural steel doors and frames shall not exceed 1/4 [\_\_\_\_\_] inch at the head and jambs and the clearance between the meeting edges of pairs of doors shall not exceed 1/2 [\_\_\_\_\_] inch.] [The lateral clearance between hollow metal doors and frames shall not exceed 1/8 inch at the head and jambs and the clearance between the meeting edges of pairs of doors shall not exceed 1/4 inch.] The clearance between the door bottom and threshold shall not exceed 3/4 inch.

#### 2.5 BLAST DOOR ASSEMBLIES

##### 2.5.1 Door [\_\_\_\_\_] ; Steel

###### 2.5.1.1 Type

Type shall be [structural steel] [double structural steel door with [fixed] [or] [removable] mullion] [,] [galvanized] [,] [and] [fire-rated].

###### 2.5.1.2 Overpressure

Overpressure shall be [\_\_\_\_\_] psi [with a [\_\_\_\_\_] millisecond duration] in the [seating] [unseating] direction [and [\_\_\_\_\_] psi [with a [\_\_\_\_\_] millisecond duration] in the unseating direction]. The [shock and gas overpressure] [overpressure] waveform shall be as indicated.

###### 2.5.1.3 Fragment

[The fragment shall be [\_\_\_\_\_] ounces with a velocity of [\_\_\_\_\_] fps and impact [normal to] [at an angle of [\_\_\_\_\_] degrees measured from] the door face.] [Protection from fragments shall be provided by steel plate not less than [\_\_\_\_\_] inches in thickness.]

###### 2.5.1.4 Rebound

Rebound resistance shall be [50] [100] [\_\_\_\_\_] percent.

###### 2.5.1.5 Deformation Limits

The ductility ratio shall not exceed [10 and the support rotation shall not exceed 2 degrees] [20 and the support rotation shall not exceed 12 degrees].

###### 2.5.1.6 Hardware

Full surface hinges shall be Type [1] [2] [3]. [Multiple] [Jamb] latching points and [multiple lever handles] [,] [or] [a single lever handle] [,] [or] [a wheel handle] [,] [or] [a spoke lever handle] operated from [the seating face] [and] [opposite the seating face] with [manual] [self-latching] latch engagement and [either] sliding [or lever] latch bolts shall be provided. The latching mechanism shall be [safety] [or] [cover] plated. A [Type [I] [II] [III] straight steel bar door pull] [,] [and] [padlock] [shrouded padlock] [,] [and] [hasp] [high security hasp] [shrouded hasp] [,] [and] [door stop] [,] [and] [surface door closer] [overhead door holder] [,] [and] [gasket seals] [door silencer] [,] [and] [optical device] shall be provided.

#### 2.5.1.7 Operating Forces

[Maximum operating forces shall be [30] [40] [\_\_\_\_\_] lbf to set the door in motion and [20] [\_\_\_\_\_] lbf to swing the door. Maximum force to engage and release latches shall be [20] [30] [40] [\_\_\_\_\_] lbf.] [Operating forces shall conform to NFPA 101.]

#### 2.5.1.8 Accessories

A [removable threshold] [or] [ramp] [and] [self-rescue kit] shall be provided.

#### 2.5.2 Door [\_\_\_\_\_] ; Concrete

##### 2.5.2.1 Type

Type shall be [reinforced concrete] [double reinforced concrete] door with [fixed] [or] [removable] [mullion] [and] [with] [spall plate] [faceplates].

##### 2.5.2.2 Overpressure

Overpressure shall be [\_\_\_\_\_] psi [with a [\_\_\_\_\_] millisecond duration] in the [seating] [unseating] direction [and [\_\_\_\_\_] psi with a [\_\_\_\_\_] millisecond duration in the unseating direction]. The [shock and gas overpressure] [overpressure] waveform shall be as indicated.

##### 2.5.2.3 Fragment

[The fragment shall be [\_\_\_\_\_] ounces with a velocity of [\_\_\_\_\_] fps and impact [normal to] [at an angle of [\_\_\_\_\_] degrees measured from] the door face.] [The nominal door thickness shall not be less than [4] [8] [\_\_\_\_\_] inches].

##### 2.5.2.4 Rebound

Rebound resistance shall be [20] [100] [\_\_\_\_\_] percent.

##### 2.5.2.5 Deformation Limits

[The door support rotation shall not exceed [1 degree] [2 degrees] for one-way acting doors without stirrups, [2] [4] degrees for one-way acting doors with stirrups, and [2] [8] degrees for two-way acting doors.] [The support rotation shall not exceed 2 degrees except that the support rotation for one-way acting doors without stirrups shall not exceed 1 degree.]

#### 2.5.2.6 Hardware

Hinges shall be Type 2. [Multiple] [Jamb] latching points and multiple lever handles operated from [the seating face] [and] [opposite the seating face] with manual latch engagement and lever latch bolts shall be provided. Type [I] [II] [III] straight steel bar door pull [,] [and] [padlock] [shrouded padlock] [,] [and] [hasp] [high security hasp] [shrouded hasp] [,] [and] [door stop] [,] gasket seals [, and optical device] shall be provided.

#### 2.5.2.7 Operating Forces

Maximum operating forces shall be [40] [\_\_\_\_\_] lbf to set the door in motion and [20] [\_\_\_\_\_] lbf to swing the door. Maximum force to engage and release latches shall be [30] [\_\_\_\_\_] lbf.

#### 2.5.2.8 Accessories

A [removable threshold] [ramp] [and] [self-rescue kit] shall be provided.

#### 2.5.3 Door [\_\_\_\_\_] ; Metal

##### 2.5.3.1 Type

Type shall be [hollow metal] [double hollow metal door with a [fixed] [or] [removable] mullion] [,] [galvanized] [;] [and] [thermal insulation] [sound-rated to STC [40] [\_\_\_\_\_] ] [, and] [fire-rated].

##### 2.5.3.2 Overpressure

Overpressure shall be [\_\_\_\_\_] psi in the [seating] [unseating] direction [and [\_\_\_\_\_] psi in the unseating direction].

##### 2.5.3.3 Rebound

Rebound resistance shall be [50] [100] [\_\_\_\_\_] percent.

##### 2.5.3.4 Hardware

[Full surface] [Mortise] hinges shall be Type [1] [2] [3]. [[Multiple] [Jamb] latch points and [multiple lever handles] [or] [a single lever handle] operated from the [seating face] [and] [opposite the seating face] with [manual] [self-latching] latch engagement and [either] sliding [or lever] latch bolts shall be provided.] [Exit device with [multiple latch points] [jamb latch points] [and with function [\_\_\_\_\_] ] shall be provided.] [Mortise lock and latch set [with function [\_\_\_\_\_] ] shall be provided.] [A [padlock] [and] [hasp] [,] [and] [door stop] [,] [and] [surface door closer] [overhead door holder] [,] [and] [gasket seals] [door silencer] [,] [and] [optical device] shall be provided.]

##### 2.5.3.5 Operating Forces

[Maximum operating forces shall be [20] [\_\_\_\_\_] lbf to set the door in motion and [15] [\_\_\_\_\_] lbf to swing the door.] [Operating forces shall conform to NFPA 101.] Maximum force shall be [20] [\_\_\_\_\_] lbf to engage and release latches.

##### 2.5.3.6 Accessories

A [removable threshold] [or] [ramp] shall be provided.

## 2.6 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit shop and field operating test reports that include values for opening and closing forces and times, forces required to operate latches, and a description of all operating tests performed.

### 2.6.1 Prototype Static Test

Static tests on prototype door assemblies shall demonstrate that the door will resist the blast overpressure. Static tests will be accepted only if the door and frame proposed are manufactured using the same materials, dimensions, and tolerances as those in the prototype static test and the static overpressure used in the test is at least two times the blast overpressure. Static test reports shall be supplemented with calculations that demonstrate rebound resistance when rebound is not tested.

### 2.6.2 Prototype Blast Test

Blast tests on the prototype door assembly shall demonstrate that the door will resist the overpressure waveform. Blast tests will be accepted only if the door and frame proposed are manufactured using the same materials, dimensions, and tolerances as those in the prototype blast tests. The rise time of the test waveform shall be zero or subject to approval. [For an overpressure with infinite duration, the overpressure used in the test shall be not less than that specified or indicated for a duration equal to at least five times the natural period of the door and the test report shall be supplemented with calculations that demonstrate the specified or indicated rebound resistance.] [For overpressure with finite duration, the overpressure waveform used in the test shall exceed the overpressure waveform in both peak overpressure and impulse and the blast test report shall be supplemented with calculations that demonstrate the specified or indicated rebound resistance when the positive phase waveform duration in the test exceeds the positive phase duration specified or indicated.] Submit certified test reports demonstrating blast resistance. Include in the test reports the name and location of the testing agency or laboratory, a description of the testing apparatus, the date of the tests, a description of the door specimen tested, descriptions of loadings, the value of measured peak door deflection and peak permanent set and analysis and interpretation of test results.

### 2.6.3 Shop Operating Test

Prior to shipment, each door assembly shall be fully erected in a supporting structure and tested for proper operation. Such testing shall include opening, closing, and operating all moving parts to ensure smooth operation and proper clearance, fit, and seating. Determine the operating forces and opening and closing times. Notify the Contracting Officer at least [7] [\_\_\_\_\_] calendar days prior to the start of testing and [all doors] [door [\_\_\_\_\_] [,] [\_\_\_\_\_] [,] [and] [\_\_\_\_\_] ] shall be tested in the presence of the Contracting Officer. Prepare a test report and furnish [three] [\_\_\_\_\_] copies within [7] [\_\_\_\_\_] calendar days after testing.

### 2.6.4 Air Leakage Test

Factory test each door assembly for which [door seals] [or] [thermal insulation] [are] [is] specified for air leakage rate in accordance with [ASTM E283](#). The rate of air leakage per unit length of crack shall not

exceed [0.20] [\_\_\_\_\_] cfm using a pressure difference of [1.57] [\_\_\_\_\_] psf. Prototype tests can be substituted for door assembly tests when the prototype door, frame, and hardware tested are equivalent to that provided or when otherwise approved.

#### 2.6.5 Sound Rating Test

The sound transmission class (STC) rating shall be determined in accordance with ASTM E90.

#### 2.6.6 Fire Rating Test and Inspection

Fire-rated door assemblies shall bear the listing identification label of the UL, or other nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with NFPA 252 and having a listing for the tested assemblies. Doors exceeding the size for which listing label service is offered shall be inspected in accordance with NFPA 80, NFPA 80A, and NFPA 101. A letter may be submitted by the testing laboratory (in lieu of a UL listing for fire door assemblies) which identifies the submitted product by manufacturer and type or model and certifies that it has tested a sample assembly and issued a current listing. Submit certificate of inspection conforming to NFPA 80, NFPA 80A, and NFPA 101 for fire doors exceeding the size for which label service is available.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install doors and frames in accordance with the manufacturer's written instructions. [Place concrete in reinforced concrete doors using the door manufacturer's standard forms.] [Pressed steel frames for hollow metal doors shall be fully grouted.] Finish paint exposed surfaces in accordance with Section 09 90 00 PAINTS AND COATINGS. Repair galvanized surfaces damaged prior to final acceptance in accordance with ASTM A780/A780M to the same thickness as the original galvanizing.

#### 3.2 TESTS

After installation is completed, field test each door for operation, clearance, fit, and seating by operating the door and hardware through at least 10 operating cycles. Test door and hardware operation using the forces specified. Provide personnel and equipment required to perform field testing. Unless waived, perform all field tests in the presence of the Contracting Officer. After testing is completed, prepare test reports and furnish [three] [\_\_\_\_\_] copies.

#### 3.3 MANUFACTURER'S FIELD SERVICE

Perform installation and testing of door assemblies under the supervision of the door manufacturer's erection engineer. Upon completion of the work, and at a time designated by the Contracting Officer, provide the services of one engineer and other technical personnel, as required, for a period of not less than [4] [\_\_\_\_\_] hours to instruct Government personnel in the operation and maintenance of the blast doors and all other items furnished under this specification. Include in the instructions videotapes and use of the operation and maintenance manual. Submit an instruction outline and procedure for approval prior to scheduling the instruction and information describing training to be provided, training aids to be used, and

background data on the personnel conducting the training.

-- End of Section --



## SECTION 08 41 13

## ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

08/18, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501 (2015) Methods of Test for Exterior Walls

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants

AAMA 1503 (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## ASTM INTERNATIONAL (ASTM)

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E330/E330M (2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain

Walls by Uniform Static Air Pressure Difference

- ASTM E331 (2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E783 (2002; R 2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- ASTM E1105 (2015) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- ASTM E1424 (1991; R 2016) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen
- ASTM E1886 (2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- ASTM E1996 (2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
- ASTM F1642/F1642M (2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

- ANSI/BHMA A156.4 (2013) Door Controls - Closers
- ANSI/BHMA A156.10 (2017) Power Operated Pedestrian Doors

INTERNATIONAL CODE COUNCIL (ICC)

- ICC IBC (2018) International Building Code

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

- FS TT-P-645 (Rev C; Notice 1) Primer, Paint, Zinc-Molybdate, Alkyd Type

UNDERWRITERS LABORATORIES (UL)

- UL 325 (2017; Reprint Feb 2020) UL Standard for Safety Door, Drapery, Gate, Louver, and

## Window Operators and Systems

## 1.2 ADMINISTRATIVE REQUIREMENTS

## 1.2.1 Pre-Installation Meetings

Conduct a meeting before installation begins to verify the project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

Within [30] [\_\_\_\_\_] days of the Contract Award, submit the following for review and approval by the Contracting Officer:

- a. List of product installations
- b. Sample warranty
- c. Finish and color samples
- d. Manufacturer's catalog data

Concurrently submit certified test reports showing compliance with specified performance characteristics and UL 325 for the following:

- a. Wind Load (Resistance) in accordance with AAMA 501
- b. Deflection in accordance with ASTM F1642/F1642M
- c. Condensation Resistance and Thermal Transmittance Performance Requirements in accordance with AAMA 1503
- d. Water Infiltration in accordance with ASTM E331
- e. Structural Requirements in accordance with ASTM F1642/F1642M

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Sample Warranty; G[, [\_\_\_\_]]

List of Product Installations; G[, [\_\_\_\_]]

## SD-02 Shop Drawings

Installation Drawings; G[, [\_\_\_\_]]

[ Fabrication Drawings; G[, [\_\_\_\_]] ]

## SD-03 Product Data

Manufacturer's Catalog Data; G[, [\_\_\_\_]]

Finish; G[, [\_\_\_\_]]

Recycled Content of Aluminum Material; S

#### SD-04 Samples

Finish and Color Samples; G[, [\_\_\_\_]]

#### SD-06 Test Reports

Certified Test Reports; G[, [\_\_\_\_]]

Deflection

Air Infiltration

Condensation Resistance and Thermal Transmittance

Water Infiltration

#### SD-08 Manufacturer's Instructions

Manufacturer's Instructions

#### SD-11 Closeout Submittals

Manufacturer's Product Warranty

### 1.4 QUALITY CONTROL

#### 1.4.1 Qualifications

##### 1.4.1.1 Installer Qualifications

Provide documentation of the installer's experience [as determined by the Contractor] in performing the work specified in this section.

Ensure that the installers are specialized in work similar to that required for this project, and that they are acceptable to product manufacturer.

##### 1.4.1.2 Manufacturer Qualifications

Ensure that manufacturers meet the requirements specified in this section and project drawings.

Ensure that the manufacturer is capable of providing field service representation during construction, approving acceptable installers and approving application methods.

#### 1.4.2 Single-Source Responsibility

When aluminum entrances are part of a building enclosure system, that includes storefront framing, windows, a curtain wall system, and related products, provide building enclosure system products from a single-source manufacturer.

Use a single source manufacturer with sole responsibility for providing design, structural engineering, and custom fabrication for door portal

systems and for supplying components, materials, and products. Do not use products provided from numerous sources for assembly at the site. Ensure that the following work items and components are fabricated or supplied by a single source are:

- a. Door assemblies to be installed in door portals as specified in [Section 08 11 16 ALUMINUM DOORS AND FRAMES] [\_\_\_\_\_].
- b. Glazed walls to be constructed around door portals as specified in [this Section] [\_\_\_\_\_].
- c. Door operating hardware to be installed on or within door portals as specified in Section 08 71 00 DOOR HARDWARE.
- d. Glass as specified in [Section 08 81 00 GLAZING] [\_\_\_\_\_].

## 1.5 DELIVERY, STORAGE, AND HANDLING

### 1.5.1 Ordering

To avoid construction delays, comply with the manufacturer's lead-time requirements and instructions for ordering.

### 1.5.2 Packing, Shipping, Handling and Unloading

Deliver materials in the manufacturer's original, unopened, undamaged containers with identification labels intact.

### 1.5.3 Storage and Protection

Store materials in a way that protects them from exposure to harmful weather conditions. Avoid damaging the storefront material and components during handling. Protect storefront material against damage from elements, construction activities, and other hazards before, during, and after storefront installation.

Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sunlight. Do not leave coating residue on surfaces.

## 1.6 PROJECT / SITE CONDITIONS

### 1.6.1 Field Measurements

Verify actual measurements or openings by taking field measurements before fabrication; record these measurements on shop drawings. To avoid construction delays, coordinate field measurements, and fabrication schedule with construction progress.

## 1.7 WARRANTY

Provide a written manufacturer's warranty, executed by a company official, warranting against defects in materials and products for [\_\_\_\_\_] [2] years from the date of shipment. Warrant that the door corner construction is for the life of the project. [Provide a written installer's warranty, warranting work to be watertight and free from defective materials, defective workmanship, and glass breakage as a result of defective design, and agreeing to replace components that fail within [\_\_] [2] years.]

The warranty states the following:

- a. Watertight and airtight system installation is completed within specified tolerances.
- b. The completed installation remains free of rattles, wind whistles and noise caused by thermal movement and wind pressure.
- c. System is structurally sound and free from distortion.
- d. Glass and glazing gaskets will not break or "pop" from frames as a result of design, wind load pressure, movement caused by expansion or contraction, or structural loading.
- e. Glazing sealants and gaskets remain free of abnormal deterioration or dislocation as a result of sunlight, weather, or oxidation.

[ Provide written warranty stating that the organic coating finish will not fade more than 10 percent or show chalking, yellowing, peeling, cracking, pitting, corroding or variations in color, or gloss deterioration beyond the manufacturer's descriptive standards for [\_\_\_\_\_] years from the shipment date and agreeing to promptly correct defects.

]

Provide a written thermal integrity warranty for [\_\_\_\_\_] years from ship date against thermal barrier system failure resulting from the following:

- a. Longitudinal and transverse thermal barrier shrinkage.
- b. Thermal barrier cracking.
- c. Structural failure of the thermal barrier material.
- d. Loss of adhesion or loss of prescribed edge pressure on glazing material, resulting in excessive air and water infiltration.

]

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

Provide aluminum entrances, with glass and glazing, door hardware, and components.

Aluminum entrances include impact resistance entrances; [medium stile, 3 1/2 inch] [\_\_\_\_\_] vertical face dimension, [ 1 3/4 inch] [\_\_\_\_\_] depth, for interior structural silicone glaze, for high-traffic/impact-resistant applications.:

#### 2.1.1 Design Requirements for Aluminum (Entrances and Components)

Provide a door portal system designed to withstand the following loads without breakage, loss, failure of seals, product deterioration, or other defects.

- a. Dead and Live Loads: Determined by **ASCE 7-16** and calculated in accordance with applicable codes.
- b. Seismic Loads: Design and install the system to comply with the seismic requirements for the project location in accordance with Section 1613 of the International Building Code, **ICC IBC**.

- c. Wind Loads: Design and install the system so that the effects of wind load acting inward and outward normal to the plane of the wall are in accordance with [ASTM E330/E330M](#).
- d. Thermal Loads And Movement:
  - (1) Ambient Temperature Range: [120] [\_\_\_\_\_] degrees F
  - (2) Material Surfaces Range: [180] [\_\_\_\_\_] degrees F
- e. Water and Air Resistance: Provide weatherstripping, exterior gaskets, sealants, and other accessories to resist water and air penetration.
- f. Impact-Protective Systems Provide an impact-protective system in accordance with [[ASTM E1886](#)] [[ASTM E1996](#)].

2.1.1.1 Material Standard

[ASTM B221](#); 6063-T5 alloy and tempered.

Provide door stile and rail face dimensions of the entrance doors as follows:

Vertical Stile	Top Rail	Bottom Rail
3-1/2 inches	3-1/2 inches	6-1/2 inches

Provide major portions of the door members at 0.125 inches nominal in thickness and glazing molding at 0.050 inches thick.

2.1.1.2 Recycled Content

Provide aluminum framed entrances and storefronts that have a minimum of 20 percent recycled content based upon the aluminum billet used in the original material. Provide data indicating percentage of [recycled content of aluminum material](#).

2.1.1.3 Sealants

Provide either ethylene propylene diene monomer (EPDM) elastomeric extrusions or thermoplastic elastomer glazing gaskets. Structural silicone sealant is required.

Internal Sealants: Provide sealants that according to the manufacturer will remain permanently elastic, tacky, non-drying, non-migrating, and weather tight.

2.1.1.4 Thermal Barrier

Use a rigid, structural thermal barrier to separate all exterior aluminum from interior aluminum. For purposes of this specification, a structural thermal barrier is defined as a system that transfers shear during bending and, therefore, promotes composite action between the exterior and interior extrusions. Do not use a nonstructural thermal barrier. Ensure that the thermal barrier provides a structural connection between the two sides of the door.

2.2 FABRICATION

Provide the following information when submitting fabrication drawings for custom fabrications:

- a. Indicate elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, and member connections.
- b. Show the following items:
  - (1) Details of special shapes.
  - (2) Reinforcing.
  - (3) Anchorage system.
  - (4) Interfacing with building construction.
  - (5) Provisions for expansion and contraction.
  - (6) Thermal breaks.
- c. Indicate typical glazing details, [locations of various types and thickness of glass][, emergency breakout locations,] and internal sealant requirements as recommended by the sealant manufacturer.
- d. Clearly indicate locations of exposed fasteners and joints.
- e. Clearly show where and how the manufacturer's system deviates from Contract drawings and these specifications.

#### 2.2.1 Entrance System Fabrication

Provide door corner construction consisting of mechanical clip fastening, SIGMA deep penetration plug welds and 1 1/8 inch long fillet welds inside and outside all four corners. Provide a hook-in type exterior glazing stop with EPDM glazing gaskets reinforced with non-stretchable cord. Provide an interior glazing stop that is mechanically fastened to the door member and that incorporates a silicone-compatible spacer used with silicone sealant.

Accurately fit and secure joints and corners. Make joints hairline in appearance. Remove burrs and smooth edges. Prepare components with internal reinforcement for door hardware. Arrange fasteners and attachments so that they are concealed from view.

Separate dissimilar metals with protective coating or pre-formed separators to prevent contact and corrosion.

#### 2.2.2 Shop Assembly

Fabricate and assemble units with joints only at the intersection of aluminum members with hairline joints; rigidly secure these units, and seal them in accordance with the manufacturer's recommendations.

##### 2.2.2.1 Welding

Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by the manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected by the Contacting Officer.



## 2.2.3 Finish

Before fabrication, clean the units and give them a [AA-M-10-C22-A31 clear (natural) anodized finish] [AA-M-10-C22-A41 clear (natural) anodized finish] [AA-M-10-C22-A32 [\_\_\_\_\_] (color) anodized finish] [AA-M-10-C22-A42 [\_\_\_\_\_] (color) anodized finish] in accordance with the requirements of the AA DAF45. The finish thickness is [A41, 0.4 mil or greater.] [A42, 0.7 mil or greater.]

## a. Organic Coating (high-performance exterior coating):

- (1) Comply with requirements of AAMA 2605.
- (2) Clean surfaces and pretreat them with a conversion coating before applying 0.3 mil dry-film thickness of epoxy or acrylic primer according to the recommendations of the finish coat manufacturer.
- (3) Apply a finish coat of [70 percent][\_\_\_\_\_] minimum fluoropolymer resin fused to primed surfaces at the temperature recommended by the manufacturer and at a minimum dry film thickness of 1.0 mil.
- (4) Use a 2-, 3-, or 4-coat system as required for the color selected.

## [ b. Clear Anodized; Conforming to [AA-M12C22A31][\_\_\_\_\_] and AAMA 611.

Select and edit the following items for the appropriate finish; delete types that do not apply.

- (1) Architectural Class II[\_\_\_\_\_]
- (2) Etched, medium matte[\_\_\_\_\_]
- (3) Clear anodic coating, 0.4 minimum thickness[\_\_\_\_\_]

## ] [ c. Color Anodized: Conforming to [AA-M12C22A [34] [44]][\_\_\_\_\_] and AAMA 611

Select and edit the following items for appropriate finish; delete types that do not apply.

- (1) Architectural Class [II] [I]
- (2) Etched, medium matte
- (3) [Black] [dark bronze][medium bronze] [light bronze] anodic coating, [ 0.4 mil][ 0.7 mil] minimum thickness

## ]2.2.4 Fabrication Tolerance

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure these units, and seal them in accordance with the manufacturer's recommendations.

Fabricate aluminum entrances in accordance with the entrance manufacturer's prescribed tolerances.

## 2.2.4.1 Material Cuts

Square to  $1/32$  inch off square, over largest dimension; proportionate amount of  $1/32$  inch on the two dimensions.

[2.2.4.2 Maximum Offset at Consecutive Members

$1/64$  inch in alignment between two consecutive members in line, end to end.

]2.2.4.3 Maximum Offset at Glazing Pocket Corners

$1/64$  inch between framing members at glazing pocket corners.

]2.2.4.4 Joints

Between adjacent members in same assembly: Joints are hairline and square to the adjacent member.

2.2.4.5 Variation

In squaring diagonals for doors and fabricated assemblies:  $1/16$  inch.

2.2.4.6 Flatness

For doors and fabricated assemblies: plus/minus  $1/16$  inch of neutral plane.

2.3 MATERIALS

2.3.1 Sealants

[ Refer to Section 07 92 00 JOINT SEALANTS. ]Ensure that all sealants conform to AAMA 800.

2.3.2 Glass

Refer to Section 08 81 00 GLAZING.

2.4 ACCESSORIES

2.4.1 Fasteners

Provide stainless steel fasteners in areas where the fasteners are exposed.

Use non-corrosive and compatible fasteners with components being fastened. Do not use exposed fasteners, except where unavoidable for application of hardware.

In areas where fasteners are not exposed, use aluminum, non-magnetic stainless steel, or other materials warranted by the manufacturer.

For exposed locations, provide countersunk Phillips head screws when items with a matching finish are fastened. For concealed locations, provide the manufacturer's standard fasteners.

Provide nuts or washers that have been designed with a means to prevent disengagement; do not deform fastener threads.

2.4.2 Perimeter Anchors

When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

#### 2.4.2.1 Inserts and Anchorage Devices

Provide manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars, or tubes. Shop-coat steel assemblies after fabrication with an alkyd zinc chromate primer complying with [FS TT-P-645](#).

#### 2.4.3 Standard Entrance Hardware

##### 2.4.3.1 Weatherstripping

Equip meeting stiles on pairs of doors with an adjustable astragal using wool pile with a polymeric fin.

Provide door weatherstripping on a single-acting offset pivot or butt-hung door and frame (single or pairs) consisting of a thermoplastic elastomer weatherstripping on a tubular shape with a semi-rigid polymeric backing.

Provide sill-sweep strips: Provide an EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Provide as necessary to meet specified performance tests.)

##### 2.4.3.2 Threshold

Provide an extruded aluminum threshold, one piece per door opening, with ribbed surface.

##### 2.4.3.3 Offset Pivots

Provide the manufacturer's standard top and bottom pivots with one intermediate offset pivot.

##### 2.4.3.4 Panic Device

Provide the manufacturer's recommended standard panic hardware.

##### 2.4.3.5 Closer

Provide a surface closer in accordance with [ANSI/BHMA A156.4](#).

##### 2.4.3.6 Security Lock or Dead Lock

Provide [A/R MS 1850A lock with two A/R 1871 cylinder operated flush bolts] [\_\_\_\_\_].

##### 2.4.3.7 Cylinder(s)/Thumb-turn

Provide the manufacturer's recommended standard.

##### 2.4.3.8 Cylinder Guard

Provide the manufacturer's recommended standard.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

### 3.1.1 Site Verification of Conditions

Verify that the condition of substrate previously installed under other sections is acceptable for product installation in accordance with the manufacturer's instructions.

Verify that openings are sized to receive the storefront system and that the sill plate is level in accordance with the manufacturer's acceptable tolerances.

### 3.2 PREPARATION

Field-verify dimensions before fabricating components for the door portal assembly.

Coordinate requirements for locations of blockouts for anchorage of door portal columns and other embedded components with Section 03 30 00 CAST-IN-PLACE CONCRETE.

Coordinate the erection of door portal with installation of surrounding glass wall and door assemblies. Ensure that the door portals can provide support and anchorage for assembly components.

Coordinate electrical requirements for [automatic door assemblies] [electrified door hardware] to ensure proper power source, conduit, wiring, and boxes.

#### 3.2.1 Adjacent Surfaces Protection

Protect adjacent work areas and finish surfaces from damage during product installation.

#### 3.2.2 Aluminum Surface Protection

Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

### 3.3 INSTALLATION

Submit [installation drawings](#) for review and approval.

Install the entrance system in accordance with the [manufacturer's instructions](#) and the AAMA storefront and entrance guide specifications manual. Attach the entrance system to the structure, allowing it to be adjusted to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten the system to the building structure. Align the assembly so that it is plumb and level, and free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

Set thresholds in a bed of mastic and secure the thresholds. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or a bituminous coating. Shim and brace the aluminum system before anchoring the system to the structure. Verify that weep holes are open, and the metal joints are sealed in accordance with the manufacturer's installation instructions. Seal metal-to-metal joints using a sealant recommended by the system manufacturer.

#### 3.3.1 Tolerances

Ensure that tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by the Aluminum Association.

### 3.3.2 Adjusting

Adjust operating hardware for smooth operation, and as recommended by the manufacturer.

### 3.3.3 Related Products Installation Requirements

#### 3.3.3.1 Sealants (Perimeter)

Refer to Section 07 92 00 JOINT SEALANTS.

#### 3.3.3.2 Glass

Refer to Section 08 81 00 GLAZING.

### 3.4 FIELD QUALITY CONTROL

#### 3.4.1 Air Infiltration

Test air infiltration in accordance with ASTM E783

Submit certified test reports showing compliance with specified performance characteristics as follows:

- a. For single-acting offset pivot, butt hung, or continuous geared hinge entrances in the closed and locked position, test the specimen in accordance with ANSI/BHMA A156.10, and ASTM E283 at a pressure differential of 1.57 psf for pairs of doors; ensure that maximum infiltration for a pair of 7 foot by 8 foot entrance doors and frame is 1.2 cfm/square foot.
- b. Ensure the maximum allowable infiltration for a completed storefront system does not exceed 0.06 cfm/square foot when tested in accordance with ASTM E1424 at a differential static pressure of 6.24 psf.

#### 3.4.2 Wind Loads

Provide a completed storefront system capable of withstanding wind pressure loads, normal to the wall plane indicated, as follows:

##### a. Exterior Walls

(1) Positive Pressure: [\_\_\_\_\_] psf

(2) Negative Pressure: [\_\_\_\_\_] psf

b. Interior Walls: (pressure acting in either direction) [\_\_\_\_\_] psf

#### 3.4.3 Deflection

Submit certified test reports showing that the maximum allowable deflection in a member when tested in accordance with ASTM E330/E330M with allowable stress is L/175 or 3/4 inches maximum.

#### 3.4.4 Condensation Resistance and Thermal Transmittance

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. U-Value Requirements:

- (1) Perform test in accordance with the AAMA 1503 procedure and on the configuration specified therein.
- (2) Thermal Transmittance ("U" Value) maximum [\_\_\_\_\_] [0.65 (6250) BTU/hr/sf/deg F] at [15] [\_\_\_\_\_] mph exterior wind.

b. CRF Class Requirements:

- (1) Perform a test in accordance with AAMA 1503.
- (2) Condensation Resistance Factor Requirements (CRF) minimum [\_\_\_\_\_].

#### 3.4.5 Water Infiltration

Submit certified test reports showing that the system is designed to provide no uncontrolled water when tested in accordance with ASTM E1105 at a static pressure of 8 psf.

### 3.5 ADJUSTING AND CLEANING

#### 3.5.1 Protection

Protect the installed product's finish surfaces from damage during construction. Protect the aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

#### 3.5.2 Cleaning

Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions before acceptance remove excess mastic, mastic smears, and other foreign materials. Remove construction debris from the project site and legally dispose of this debris.

### 3.6 WARRANTY

Submit [three] [\_\_\_\_\_] signed copies of the manufacturer's product warranty for the entrance system as follows:

- a. Warranty Period: [Five] [\_\_\_\_\_] years from Date of Substantial Completion of the project, provided that the Limited Warranty begins no later than [six] [\_\_\_\_\_] months from the date of shipment by the manufacturer. In addition, support welded door corner construction with a limited lifetime warranty for the life of the door under normal use.

Ensure that the Warranty's language is identical to the "As Approved" version of the sample warranty submitted to and returned from the Contracting Officer.

-- End of Section --

## SECTION 08 44 00

## CURTAIN WALL AND GLAZED ASSEMBLIES

05/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASD1 (2017; Errata 2017) Aluminum Standards and Data
- AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 501.1 (2017) Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure
- AAMA 501.2 (2015) Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems
- AAMA 501.4 (2018) Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift
- AAMA 501.5 (2007) Test Method for Thermal Cycling of Exterior Walls
- AAMA 501.6 (2018) Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from Window Wall, Curtain Wall and Storefront Systems
- AAMA 501.7 (2017) Recommended Static Test Method for Evaluating Windows, Window Wall, Curtain Wall and Storefront Systems Subjected to Vertical Inter-Story Movements
- AAMA 609 & 610 (2015) Cleaning and Maintenance Guide for Architecturally Finished Aluminum
- AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants

AAMA 2603	(2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
AAMA 2604	(2017a) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
AAMA 2605	(2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
AAMA CW-10	(2015) Care and Handling of Architectural Aluminum from Shop to Site
AAMA MCWM-1	(1989) Metal Curtain Wall Manual
AAMA/WDMA/CSA 101/I.S.2/A440	(2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard
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## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121	(2007) Standard Definitions for Use in the Design of Steel Structures
AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures
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## AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.10/A5.10M	(2021) Welding Consumables - Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys - Classification
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M	(2020) Standard Specification for Steel Castings, Carbon, for General Application
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ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240/A240M	(2020a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A242/A242M	(2013; R 2018) Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A424/A424M	(2009a; R 2016) Standard Specification for Steel Sheet for Porcelain Enameling
ASTM A501/A501M	(2021) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588/A588M	(2019) Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A606/A606M	(2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability,

	Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B85/B85M	(2018) Standard Specification for Aluminum-Alloy Die Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B136	(1984; R 2013) Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B137	(1995; R 2021) Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
ASTM B152/B152M	(2019) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211/B211M	(2019) Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B244	(2009; R 2021) Standard Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
ASTM B308/B308M	(2010; R 2020) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B316/B316M	(2020) Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods
ASTM B429/B429M	(2010; E 2012) Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C220	(1991; R 2015) Standard Specification for Flat Asbestos-Cement Sheets

ASTM C481	(1999; R 2011) Standard Test Method Laboratory Aging of Sandwich Constructions
ASTM C542	(2005; R 2017) Standard Specification for Lock-Strip Gaskets
ASTM C547	(2019) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2022) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2021) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C592	(2022a) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C610	(2015) Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C665	(2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C864	(2005; R 2015) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1048	(2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM C1087	(2016) Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
ASTM C1135	(2015) Standard Test Method for

	Determining Tensile Adhesion Properties of Structural Sealants
ASTM C1184	(2014) Standard Specification for Structural Silicone Sealants
ASTM C1363	(2019) Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
ASTM C1401	(2014) Standard Guide for Structural Sealant Glazing
ASTM D1037	(2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D1730	(2009; R 2020) Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D3656/D3656M	(2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior

Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

- ASTM E331 (2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E546 (2014; R 2020) Standard Test Method for Frost Point of Sealed Insulating Glass Units
- ASTM E576 (2014; R 2020) Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position
- ASTM E783 (2002; R 2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- ASTM E1105 (2015) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- ASTM E1300 (2016) Standard Practice for Determining Load Resistance of Glass in Buildings
- ASTM E1332 (2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation
- ASTM E1886 (2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- ASTM E1996 (2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
- ASTM E3061 (2017) Standard Test Method for Analysis of Aluminum and Aluminum Alloys by Inductively Coupled Plasma Atomic Emission Spectrometry (Performance-Based Method)
- ASTM F1642/F1642M (2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
- ASTM F2248 (2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

ASTM F2912 (2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 (2006) Metal Finishes Manual

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2020) Procedure for Determining Fenestration Product U-Factors

NFRC 200 (2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

NFRC 500 (2010) Procedure for Determining Fenestration Product Condensation Resistance Values

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 285 (2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001 (1996) Specification for Architectural Porcelain Enamel (ALS-100)

PEI CG-3 (2005) Color Guide for Architectural Porcelain Enamel

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4 (2007) Brush-Off Blast Cleaning

SSPC SP 1 (2015) Solvent Cleaning

SSPC SP 3 (2018) Power Tool Cleaning

SSPC SP 12/NACE No.5 (2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

STEEL WINDOW INSTITUTE (SWI)

SWI AGSW (2002) Architect's Guide to Steel Windows

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01 (2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Glazed Curtain Wall System; G[, [\_\_\_\_]]

Installation Drawings

Shop-Painting Aluminum; G[, [\_\_\_\_]]

Shop-Painting Steel; G[, [\_\_\_\_]]

#### SD-03 Product Data

Glazed Curtain Wall System; G[, [\_\_\_\_]]

Metals For Fabrication; G[, [\_\_\_\_]]

Nonskinning Sealing Compound; G[, [\_\_\_\_]]

Metal Accessories; G[, [\_\_\_\_]]

Curtain-Wall Framing Members; G[, [\_\_\_\_]]

Aluminum Doors and Frames; G[, [\_\_\_\_]]

Laminated Panels; G[, [\_\_\_\_]]

Thermal Insulation Materials; G[, [\_\_\_\_]]

Masonry Anchorage Devices; G[, [\_\_\_\_]]

[ Recycled Content of Aluminum Doors and Frames; S

] [ Recycled Content of Aluminum Curtain-Wall Framing Members; S

] [ Recycled Content of Aluminum Windows; S

] Sample Warranties; G[, [\_\_\_\_]]

#### SD-05 Design Data

[ Anodic Finish; G[, [\_\_\_\_]]

] [ Pigmented Organic Coating; G[, [\_\_\_\_]]

] Exposed-to-View Aluminum Finish; G[, [\_\_\_\_]]

Seismic Calculations; G[, [\_\_\_\_]]

Structural Calculations for Deflection; G[, [\_\_\_\_]]

[ Design Analysis; G[, [\_\_\_\_]]

## ] SD-06 Test Reports

[ NFPA 285 Factory Test Results; G[, [\_\_\_\_\_]]

][ Standard Airblast Test; G[, [\_\_\_\_\_]]

] Field Water Spray Test Results; G[, [\_\_\_\_\_]]

Air Infiltration Test Results; G[, [\_\_\_\_\_]]

Water Penetration Test Results; G[, [\_\_\_\_\_]]

## SD-07 Certificates

Energy Performance Certificates; G[, [\_\_\_\_\_]]

[ Engineer Qualifications; G[, [\_\_\_\_\_]]

] Qualifications for the Curtain-Wall Installer; G[, [\_\_\_\_\_]]

## SD-08 Manufacturer's Instructions

Glazed Curtain Wall System; G[, [\_\_\_\_\_]]

Insulating Glass; G[, [\_\_\_\_\_]]

Preventive Maintenance and Inspection; G[, [\_\_\_\_\_]]

## SD-11 Closeout Submittals

Warranty; G[, [\_\_\_\_\_]]

## 1.3 QUALITY ASSURANCE

## 1.3.1 Engineer Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The [engineer] performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

## 1.3.2 Qualification of Welders

Welding must be performed by certified welders qualified in accordance with **AWS D1.1/D1.1M** using procedures, materials, and equipment of the type required for the work.

## 1.3.3 Qualifications for the Curtain-Wall Installer

Submit a written description of the proposed curtain-wall system installer giving the name of the curtain-wall manufacturer, qualifications of personnel, years of concurrent contracting experience, lists of projects similar in scope to the specified work. Installer must be approved by the Manufacturer as a Certified Installer and have a minimum of 5 years experience installing curtain wall systems, and have completed projects similar in size to this project.



#### 1.3.4 Testing Requirements

The components listed below must be tested in accordance with the requirements below, and meet performance requirements specified.

- a. Joint and Glazing Sealants: Perform tests as required by applicable publications referenced.
- b. Preformed Compression Gaskets and Seals: [ASTM C864](#).
- c. Preformed Lock-strip Gaskets: [ASTM C542](#), modified as follows: Heat age specimens seven days at [158 degrees F](#), in zipped or locked position under full design compression. Unzip, cool for one hour, re-zip, and test lip seal pressure, which must be minimum [2.5 pounds per linear inch](#) on any extruded or corner specimen.
- d. Spandrel Glass: Fallout resistance test, [ASTM C1048](#).
- e. Porcelain Enamel: Acid resistance, color retention, and spall resistance tests, [PEI 1001](#).
- f. Anodized Finishes: Stain resistance, coating weight, and coating thickness tests, [ASTM B136](#), [ASTM B137](#), and [ASTM B244](#), respectively.
- g. Insulating Glass: [ASTM E546](#) or [ASTM E576](#) at [minus [20 degrees F](#)] [\_\_\_\_], no frost or dew point.

#### [1.3.5 Mockup

##### 1.3.5.1 Construction

Construct at [job site] [manufacturer's plant] [approved testing laboratory] full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, and other accessories as detailed and specified. Mock-up wall unit size and design must be as indicated.

##### 1.3.5.2 Performance Test

Conduct tests after approval of visual aspects has been obtained. Finished work must match approved mock-up.

##### 1.3.5.3 Approved Mock-Up

After completion and approval of test results [[transport mock-up to job site and] install, where directed, for reference during construction.] [Approved mock-up must remain property of the Contractor.]

#### ]1.3.6 Factory Tests

Perform the following tests except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested, under the conditions specified herein, the resulting test reports may be submitted in lieu of testing the components listed below:

- a. [[NFPA 285 Factory Test Results](#)]
- b. [\_\_\_\_\_]

c. [\_\_\_\_\_]

#### 1.3.6.1 Deflection and Structural Tests

Curtain wall framing members must not deflect, in a direction normal to the plane of the wall, more than 1/175 of its clear span or 3/4 inch, whichever is less, when tested in accordance with [ASTM E330/E330M](#), except that when a plastered surface will be affected the deflection must not exceed 1/360 of the span. Framing members must not have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with [ASTM E330/E330M](#) for a minimum test period of 10 seconds at 1.5 times the design wind pressures specified. Provide [Structural Calculations for Deflection](#).

#### 1.3.6.2 Water Penetration Test

Water penetration must not occur when the wall is tested in accordance with [ASTM E331](#) at a differential static test pressure of 20 percent of the inward acting design wind pressure as specified, but not less than 12 psf. Make provision in the wall construction for adequate drainage to the outside of water leakage or condensation that occurs within the outer face of the wall. Leave drainage and weep openings in members and wall open during test. [ Test curtain wall systems in areas subject to hurricanes and typhoons in accordance with [AAMA 501.1](#) Dynamic Testing.]

#### 1.3.6.3 Air Infiltration Test

Air infiltration through the wall, when tested in accordance with [ASTM E283](#), must not exceed 0.06 cfm per square foot of fixed wall area, plus the permissible allowance specified for operable windows within the test area, at a static air pressure differential of 6.2 psf.

#### 1.3.6.4 Delamination Test

Adhesively bonded metal-faced [[\_\_\_\_\_] faced] panels must show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in [ASTM D1037](#).

#### 1.3.6.5 Sealant Adhesion and Compatibility Testing

[ASTM C1401](#), submit to structural glazing sealant manufacturer, for testing indicated below. Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

- a. Compatibility: Test materials or components using [ASTM C1087](#).
- b. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using [ASTM C1135](#).
- c. Submit no fewer than [8] [\_\_\_\_\_] pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
- d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

- e. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
- f. Testing will not be required if data based on previous testing of current sealant products match those submitted.

#### 1.3.6.6 Energy Performance Tests

[Energy Performance Certificates](#) for Glazed Aluminum Curtain Wall, Accessories, and Components from Manufacturer Confirming NFRC- Certified Energy Performance Values for Each Glazed Aluminum Curtain Wall.

The thermal transmittance of opaque panels must not exceed specified U-value, when tested in accordance with [ASTM C1363](#). Certify and Label Energy Performance according to NFRC as follows:

- a. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system must have U-factor of not more than [0.29 Btu/sq. ft. x h x deg F] [0.36 Btu/sq. ft. x h x deg F] [0.38 Btu/sq. ft. x h x deg F] [0.41 Btu/sq. ft. x h x deg F] [0.46 Btu/sq. ft. x h x deg F] [0.50 Btu/sq. ft. x h x deg F] as determined according to [NFRC 100](#).
- b. SHGC: Fixed glazing and framing areas as a system must have a SHGC of no greater than [0.22] [0.25] [0.26] [0.29] [0.40] [0.45] as determined according to [NFRC 200](#).
- c. Condensation Resistance: Fixed glazing and framing areas as a system must have an NFRC-certified condensation resistance rating of no less than [45] [55] [65] [80] as determined according to [NFRC 500](#).

#### 1.3.6.7 Window Tests

Windows must meet the requirements specified in [\_\_\_\_\_] except where the requirements of this section differ, this section governs. Provide windows that meet the same requirements for deflection and structural adequacy as specified for framing members when tested in accordance with [ASTM E330/E330M](#), except permanent deformation must not exceed 0.4 percent; there must be no glass breakage, and no permanent damage to fasteners, anchors, hardware, or operating devices. Provide windows that have no water penetration when tested in accordance with [ASTM E331](#).

#### 1.3.6.8 Fire Resistance Tests

Insulation [provided in the curtain wall system] [field applied in conjunction with the curtain wall system] must have a flame spread rating not exceeding 75 and a smoke developed rating not exceeding 150 when tested in accordance with [ASTM E84](#), except as specified otherwise herein.

- a. Insulation: Insulation [contained entirely within panel assemblies which meets the flame spread and smoke developed ratings of 75 and 150 respectively] [isolated from the building interior by masonry walls, masonry cavity walls, or encased in masonry cores] is not required to comply with the flame spread and smoke developed ratings specified.
- b. Curtain Wall Systems: Material for firestopping the opening between the edge of the floor slab and back of the curtain wall system, must not have less than the flame spread and smoke developed ratings specified for insulation which is neither isolated from the building

interior nor encased in masonry cores. [ When required, entire curtain wall system must conform to [NFPA 285](#).]

- c. Curtain Wall Panels: Provide panels for fire resistive curtain walls that have a fire resistive rating of [\_\_\_\_\_] hours when tested in accordance with [ASTM E119](#).
- d. Firestopping Materials and Devices: Firestopping material and attachment devices must be an effective barrier against the spread of fire, smoke, and gases for a period of [\_\_\_\_\_] hours when exposed to the conditions of the standard [ASTM E119](#) time-temperature curve for a period equivalent to the fire rating of the floor system and must also be rated noncombustible when tested in accordance with [ASTM E136](#).

#### 1.3.6.9 Noise Reduction

Test according to [ASTM E90](#), with ratings determined by [ASTM E1332](#), as follows: Outdoor-Indoor Transmission Class: Minimum [26] [30] [34] [\_\_\_\_\_] . Sound Transmission Class: Minimum [31] [34] [37] [40] [\_\_\_\_\_] .

#### 1.4 FIELD TESTS

Testing must be performed by a testing agency regularly engaged in testing of architectural products, not affiliated with the curtain wall installer, and experienced with these test methods. Notify the Contracting Officer a minimum of seven calendar days prior to performing field tests.

##### 1.4.1 Field Water Spray Tests

Engage a qualified testing agency to perform tests and inspection. Perform test on [one bay of at least 30 feet long by one story] [a representative area of glazed curtain wall]. Perform water-spray test before interior finishes have begun, in accordance with [AAMA 501.2](#). Test area must not show evidence of water penetration. Perform a minimum of [2] [3] [\_\_\_\_\_] tests. Submit [Field Water Spray Test Results](#).

##### 1.4.2 Air Infiltration

[ASTM E783](#) at 1.5 times the rate specified for laboratory testing under factory test paragraph, but not more than 0.06 cfm/sq.ft at a static air pressure differential of 6.24 lbf/sq.ft. Perform a minimum of [2] [3] tests in representative areas. Submit [Air Infiltration Test Results](#).

##### 1.4.2.1 Water Penetration

[ASTM E1105](#) at a minimum [uniform] [and] [cyclic] static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and must not evidence water penetration. Submit [Water Penetration Test Results](#).

#### 1.5 GLAZED CURTAIN WALL SYSTEM REQUIREMENTS

Provide system complete with framing, mullions, trim, [framed pre-assembled units,] panels, windows, glass, glazing, sealants, insulation, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing the wall to the structure as specified or indicated.

Submit [installation drawings](#) for curtain wall system, accessories[, and

mock-up]. [ Tentative approval of drawings must be received before fabrication of mock-up. Final approval of drawings will be deferred pending approval of mock-up and accessories.] Drawings must indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

#### 1.5.1 Source

Furnish curtain wall system components by one manufacturer or fabricator; however, all components need not be products of the same manufacturer.

#### 1.5.2 Design

[Stick system] [Unit system] [Unit and mullion system] [[\_\_\_\_\_] system] with [mullions,] [horizontal rails,] [panels,] [window units,] [screens] [framed pre-assembled units with [integral] [nonintegral] spandrel panels [\_\_\_\_\_] ]. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.

#### 1.5.3 Tolerances

Design and erect wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified. Provide with the following tolerances:

- a. Maximum variation from plane or location shown on approved shop drawings:  $1/8$  inch per 12 feet of length up to not more than  $1/2$  inch in any total length.
- b. Maximum offset from true alignment between two identical members abutting end to end in line:  $1/16$  inch.

#### 1.5.4 Structural Requirements

Members may not deflect in a direction parallel to the plane of the wall, when carrying its full design load, more than an amount which will reduce the edge cover or glass bite below 75 percent of the design dimension. After deflection under full design load, members may not have a clearance between itself and the top of the panel, glass, sash, or other part immediately below it less than  $1/8$  inch. The clearance between the member and an operable window or door must be minimum  $1/16$  inch. [Design system members serving as guide rails for window cleaning equipment to carry mid-span concentrated load of [\_\_\_\_\_] pounds normal to plane of wall and [\_\_\_\_\_] pounds applied horizontally, parallel to wall plane without deflection which would affect adjacent surfaces.] Design entire system to withstand the indicated wind and concentrated loads, and the following wind loads acting normal to the plane of the wall:

- a. On the first [\_\_\_\_\_] stories above grade [\_\_\_\_\_] psf acting inward, and the same load acting outward.
- b. On the next [\_\_\_\_\_] stories above grade [\_\_\_\_\_] psf acting inward, and the same load acting outward.

- c. On corner areas, extending [\_\_\_\_\_] feet from the building corners on the [\_\_\_\_\_] stories, on all facades, the outward-acting (negative) design load must be increased to [\_\_\_\_\_] pounds per square foot.

#### [1.5.5 Seismic Calculations

When tested to AAMA 501.4 and AAMA 501.6, system must meet design displacement of 0.010 times the story height and ultimate displacement of 1.5 times the design displacement. Provide with the following tolerances:

- a. Phase I: 3 stroke cycles using .005 times the story height - no damage or failure.
- b. Phase II: 3 stroke cycles using .010 times the story height - no damage or failure.

#### ]1.5.6 Thermal Cycling and Vertical Inter-Story Movement Calculations

- a. Thermal Cycling: AAMA 501.5. Repeat the Air Infiltration Test, ASTM E283, and the Water Penetration Test Under Static Pressure, ASTM E331.
- b. Inter-Story Drift: AAMA 501.4 and AAMA 501.7 at 100 percent of design displacement. Repeat the Air Infiltration Test, ASTM E283 and the Water Penetrated Test Under Static Pressure, ASTM E331.

### 1.6 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage; unload and store with a minimum of handling in accordance with recommendations contained in AAMA CW-10. Storage spaces must be dry locations with adequate ventilation, free from heavy dust, not subject to combustion products or sources of water, and must allow for easy access for inspection and handling. Deliver caulking and sealing compounds to the job site in sealed containers labeled to show the designated name, formula or specifications number; lot number; color; date of manufacturer; shelf life; and curing time when applicable.

#### 1.6.1 Protective Covering

Prior to shipment from the factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of [aluminum] [stainless steel] with protective covering of adhesive paper, waterproof tape, or strippable plastic. Covering must not chip, peel, or flake due to temperature or weather, must protect against discoloration and surface damage from transportation, and storage, and must be resistant to alkaline mortar and plaster. Do not cover [aluminum] [stainless steel] surfaces that will be in contact with sealants after installation.

#### 1.6.2 Identification

Prior to delivery, mark wall components to correspond with shop and erection drawings placement location and erection.

### 1.7 WARRANTY

Guarantee insulating glass units not to develop material obstruction of vision as a result of dust or film formation on the inner glass surface caused by failure of the seal, other than through glass breakage, within a

period of 5 years from date of acceptance of work by the Government. Replace units failing to comply with the terms of this guarantee with new units without additional cost to the Government. The Contractor must require the manufacturer to execute their warranties in writing directly to the Government.

#### 1.7.1 Sample Warranties

Provide curtain wall and glazing assembly material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty to comply with the specified requirements.

- a. Project Warranty: Refer to Section 01 11 00 SUMMARY OF WORK.
- b. Manufacturer's Warranty: Submit, for acceptance, the Manufacturer's standard warranty document executed by authorized company official. The manufacturer's warranty is in addition to, and not a limitation of, other rights the Government may have under the Contract Documents.
- c. Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel fire-rated glazed curtain-wall systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
- d. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering. Deterioration includes, but is not limited to, color fading more than 5 Delta E units when tested according to ASTM D2244, chalking in excess of a No. 8 rating when tested according to ASTM D4214, cracking, peeling, or chipping.
- e. Beneficiary: Issue warranty to the Government.
- f. Warranty Period: [5] [10] [\_\_\_\_\_] years commencing on Date of Substantial Completion, covering complete curtain wall system for failure to meet specified requirements.
- g. Warranty Acceptance: Owner is sole authority who will determine acceptability of manufacturer's warranty documents.

#### 1.8 INTERPRETATION OF AWS CODE

Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.

AWS code, when referred to herein, means AWS D1.1/D1.1M, "Structural Welding Code - Steel" with the following modification:

Revise AWS code Section 1, "General Provisions," Paragraph 1.1 as follows: References to the need for approval means "Approval by the Contracting Officer" and references to the "Building Commissioner" means the "Contracting Officer."

#### 1.9 PERFORMANCE REQUIREMENTS

##### [1.9.1 Antiterrorism Performance Requirements

Curtain Wall assembly must meet the antiterrorism performance criteria specified in the paragraphs below and [UFC 4-010-01](#). One of the following methods must validate conformance to the performance requirements.

#### 1.9.1.1 Computational Design Analysis Method

Submit design analysis with calculations showing that the design of each different size and type of aluminum curtain wall and its anchorage to the structure meets the antiterrorism standards required by paragraph ANTITERRORISM PERFORMANCE REQUIREMENTS, unless conformance is demonstrated by Standard Airblast Test results. Calculations verifying the structural performance of each curtain wall proposed for use, under the given loads, must be prepared and signed by a registered Professional Engineer. The curtain wall components and anchorage devices to the structure, as determined by the design analysis, must be reflected in the shop drawings.

Design curtain wall assembly to the criteria listed herein. Computational [design analysis](#) must include calculations verifying the structural performance of each curtain wall assembly proposed for use, under the given static equivalent loads.

Design curtain wall frames, mullions, sashes, and glazing to the criteria listed herein. Computational design analysis must include calculations verifying the structural performance of each window system proposed for use, under the given static equivalent loads.

Glazing resistance must be greater than equivalent 3-second duration loading of [\_\_\_\_\_] [pounds per square foot \(psf\)](#) for type [\_\_\_\_\_] window [per Window Schedule indicated on the drawings] [ and [\_\_\_\_\_] [psf](#) for the remaining window types]. The glazing frame bite for the window frames must be in accordance with [ASTM F2248](#).

Aluminum/Steel window framing members must restrict deflections of the edges of glazing they support to L/60 under two times (2X) the glazing resistance per the requirements of [ASTM F2248](#) and [ASTM E1300](#).

[ Anchor curtain wall frames to the supporting structure with anchors designed to resist [two times (2X)] [one time (1x)] the glazing resistance in accordance with [ASTM F2248](#) and [ASTM E1300](#).

#### ]1.9.1.2 Dynamic Design Analysis Method

Design curtain wall assembly using a dynamic analysis to prove the system will provide performance equivalent to or better than a [low]; [very low]; [\_\_\_\_\_] hazard rating in accordance with [ASTM F2912](#) for the peak positive pressure of [\_\_\_\_\_] [pounds per square inch \(psi\)](#); and peak positive phase impulse of [\_\_\_\_\_] [pounds per square inch - millisecond \(psi-msec\)](#). Use a triangular blast load using the applicable pressure and impulse indicated above. The allowable response limits of [aluminum]; [steel] frame elements are as follows: Maximum ductility ratio of [\_\_\_\_\_] and maximum support rotation of [\_\_\_\_\_] degrees.

#### 1.9.1.3 [Standard Airblast Test](#) Method

For Antiterrorism curtain wall, in lieu of a Design Analysis, include in a test report results of airblast testing, whether by arena test or shock tube providing information in accordance with [ASTM F1642/F1642M](#), as prepared by the independent testing agency performing the test. Demonstrate in the test results the ability of each curtain wall proposed



for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph STANDARD AIRBLAST TEST METHOD. Demonstrate in the test results the ability of each curtain wall proposed for use to withstand the airblast loading parameters and achieve [low]; [very low] hazard level rating or better when rated per the requirements of ASTM F2912.

As an alternative to the 'Computational Design Analysis Method' and 'Dynamic Design Analysis Method' indicated above, curtain wall assembly may be tested for evaluation of hazards generated from airblast loading in accordance with ASTM F1642/F1642M by an independent testing agency regularly engaged in blast testing. For proposed window systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed window size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems in accordance with ASTM F2912. Proposed window system/assembly of a size outside this range requires testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. Perform the test on the entire proposed window system/assembly, which must include, but not be limited to, the glazing, its framing/support system, operating devices, and all anchorage devices. Anchorage of the window support system must replicate the method of installation to be used for the project. The minimum airblast loading parameters for the test must be as follows: peak positive pressure of [ ] pounds per square inch (psi) and peak positive phase impulse of [ ] pounds per square inch - millisecond (psi-msec). The hazard rating for the proposed window systems, as determined by the rating criteria of ASTM F2912, to provide performance equivalent to or better than a [low]; [very low]; [ ] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard", "Very Low Hazard" and "Low Hazard" ratings are acceptable. "High Hazard" ratings are unacceptable. Results of window systems previously tested by test protocols other than ASTM F1642/F1642M may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

#### [1.9.1.4 Wind-Borne Debris /Hurricane Performance Requirements

Provide impact resistant or protected curtain wall systems in buildings with an impact-resistant covering meeting the Windborne-Debris-Impact-Resistant Performance requirements of ASTM E1996 for project wind zone when tested in accordance with ASTM E1886, based upon testing of specimens not less than the size required for project and utilizing installation method identical to that specified for project as follows:

- a. Project Wind Zone: [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4].
- b. Large-Missile Test: For glazing located within 30 feet of grade.
- c. Small-Missile Test: For glazing located more than 30 feet above grade.

#### ]1.9.2 Allowable Design Stresses

Aluminum-alloy framing member allowable design stresses must be in accordance with the requirements of AA ADM pertaining to building type structures made of the specified aluminum alloy.

Hot-rolled structural-steel member allowable design stresses and design rules must be in accordance with the requirements of [AISC/AISI 121](#) pertaining to the specified structural steel.

Cold-formed light-gage steel structural member allowable design stresses and design rules must be in accordance with the requirements of [AISI SG03-3 SG570](#) pertaining to structural members formed from the specified structural-steel sheet or strip.

### 1.9.3 Design Wind Load

Design windload must be [45] [41] [38] [35] [30] [15] pounds per square foot. Design windload must be in accordance with [ASCE 7-16](#).

### 1.9.4 Structural Capacity

Design curtain-wall system, including framing members, windows, doors and frames, metal accessories, panels, and glazing to withstand the specified design windload acting normal to the plane of the curtain wall and acting either inward or outward.

Deflection of any metal framing member in a direction normal to the plane of the curtain wall, when subjected to the test of structural performance, using the specified windload in accordance with [AAMA/WDMA/CSA 101/I.S.2/A440](#), must not exceed 1/175 of the clear span of the member or 3/4 inch, whichever value is less.

Deflection of any metal member in a direction parallel to the plane of the curtain wall, when the metal member is carrying its full design load, must not exceed 75 percent of the design clearance dimension between that member and the glass, sash, panels, or other part immediately below it.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Aluminum

Must be free from defects impairing strength or durability of surface finish. Provide standard alloys conforming to standards and designations of [AA ASD1](#). Special alloys, not covered by the following ASTM specifications, must conform to standards and designations recommended by the manufacturer for the purpose intended.

[ Provide Aluminum [Doors] [Frames] [Curtain-wall Framing Members] [Window Frames] with a minimum recycled content of 20 percent. Provide data identifying percentage of [recycled content of aluminum doors and frames] [recycled content of aluminum curtain-wall framing members] [recycled content of aluminum windows].

#### ]2.1.1.1 Wrought Aluminum Alloys

Must be those which include aluminum alloying elements not exceeding the following maximum limits when tested and additional in accordance with [ASTM E3061](#). These limits apply to both bare products and the core of clad products. The cladding of clad products must be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core. Special wrought alloys with a silicon content not more than 7.0 percent will be acceptable for limited

structural uses where special appearance is required:

<u>ALLOY</u>	<u>MAXIMUM PERCENT</u>
Silicon	1.5
Magnesium, Manganese, and Chromium combined	6.0
Iron	1.0
Copper	0.4
Zinc	1.0

Within the chemical composition limits set forth above, wrought aluminum alloys must conform to the following:

- a. Extruded bars, rods, shapes and tubes: [ASTM B221](#) and [ASTM B308/B308M](#) and [ASTM B429/B429M](#).
- b. Sheet and Plate: [ASTM B209](#).

#### 2.1.1.2 Cast Aluminum Alloys

Provide those in which the alloying elements are silicon, magnesium, manganese, or a combination of these. Other elements must not exceed the following limits:

<u>ALLOY</u>	<u>MAXIMUM PERCENT</u>
Iron	1.2
Copper	0.4
Nickel	0.4
Titanium	0.2
Others (total)	0.5

Within the chemical composition limits set forth above, cast aluminum alloys must conform to the following:

- a. Sand castings: [ASTM B26/B26M](#).
- b. Die casting: [ASTM B85/B85M](#).
- c. Permanent mold castings: [ASTM B108/B108M](#).

#### 2.1.1.3 Welding Rods and Electrodes

Provide welding rods and bare electrodes conforming to [AWS A5.10/A5.10M](#) as recommended by the manufacturer of the aluminum base metal alloy being used.

#### 2.1.1.4 Strength

Aluminum extrusions for framing members used in curtain walls and main frame and sash or ventilator members in windows must have a minimum ultimate tensile strength of 22,000 psi and a minimum yield strength of 16,000 psi.

#### 2.1.2 Bronze

Bronze sheets, tubes, and drawn shapes must be commercial bronze, alloy No. 220. Extruded shapes must be architectural bronze, alloy No. 385. Rolled or drawn rods must be [commercial bronze, alloy No. 220] [or] [architectural bronze, alloy No. 385]. Bronze used for [\_\_\_\_\_] must have a [\_\_\_\_\_] finish.

#### 2.1.3 Copper

Conform to ASTM B152/B152M, hot or cold-rolled of the temper suitable for the respective forming operations.

#### 2.1.4 Carbon Steel

Conform to the following specifications:

- a. Rolled shapes, plates, and bars: ASTM A36/A36M.
- b. Galvanized sheets: ASTM A653/A653M.
- c. Sheets for porcelain enameling: ASTM A424/A424M.
- d. Other sheets: ASTM A1011/A1011M or ASTM A1008/A1008M.

#### 2.1.5 Stainless Steel

Conform to ASTM A240/A240M. Conform to Type 302 or 304, and finish in accordance with the NAAMM AMP 500. Conform to Metal Finishes Manual as follows:

- a. Concealed flashings: Dead soft fully annealed, [2 D finish] [[\_\_\_\_\_] finish].
- b. Exposed work: [No. 4 finish] [[\_\_\_\_\_] finish] to match approved sample.

#### 2.1.6 Weathering High-Strength Low-Alloy Steel

Weathering steel must be a high-strength, low-alloy steel conforming to ASTM A242/A242M, ASTM A588/A588M, ASTM A606/A606M, and ASTM A1011/A1011M as applicable to the shapes and thicknesses required. In addition, the steel must be capable of developing a tightly adhered protective oxide coating when left unpainted and subjected to atmospheric exposure. Provide steel that conforms to the manufacturer's published mechanical properties and chemical composition. [Protect weathering steel used for [\_\_\_\_\_] on the unexposed side with a shop coat of paint.] Perform cleaning, surface preparation, handling, bolting, riveting, and welding of weathering steel in strict accordance with the specification and recommendations of the steel manufacturer.

#### 2.1.7 High-Strength, Low-Alloy Steel

Conform to [ASTM A572/A572M](#) for structural shapes, plates, and bars.

#### 2.1.8 Metal Fasteners

Provide fasteners as specified in paragraph entitled "Fastener Metals for Joining Various Metal Combinations" in "Part 2 - Products" of the [AAMA MCWM-1](#). [ Fastener metals used in connection with weathering steel must be of type recommended by the weathering steel manufacturer.] Metals for fasteners must be chemically and galvanically compatible with contiguous materials.

#### 2.1.9 Porcelain Enamel

Apply to all areas of each unit over base metal surfaces of [metal facing panels,] [adhesively bonded panels, metal-faced,] in compliance with [PEI 1001](#). Apply colored enamel to exposed faces as follows:

- a. Color: [\_\_\_\_\_].
- b. Texture: [\_\_\_\_\_].
- c. Gloss: [\_\_\_\_\_].
- d. Thickness of coating: [\_\_\_\_\_].

#### 2.1.10 Joint Sealants and Accessories

Provide manufacturer's standard colors to closely match adjacent surfaces. For interior application of joint sealants comply with applicable regulations regarding reduced VOC's as specified in Sections [07 92 00 JOINT SEALANTS](#) and [01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING](#).

##### 2.1.10.1 Elastomeric, Single or Multiple Component

[ASTM C920](#), [Type S, single component] [Type M, multiple component]. Use Grade NS, nonsag type in joints on vertical surfaces and use Grade P, self-leveling or flow type, in joints on horizontal surfaces.

##### 2.1.10.2 Single Component Silicone Rubber Base

[ASTM C920](#), Type S, Grade NS (Silicone).

##### 2.1.10.3 Solvents and Primers

Provide material which is quick drying, colorless, nonstaining, compatible with compound used, as recommended by sealant manufacturer. Where primer is specified or recommended by sealant manufacturer, manufacturer's data related to that material must include primer.

##### 2.1.10.4 Structural Sealant

[ASTM C1184](#) and [ASTM C1401](#). Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant must occur before adhesive failure. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's

internal strength.

#### 2.1.10.5 Backing Material

Provide material which is nonstaining, nonabsorbent, and compatible with sealing compound. Closed cell resilient urethane, polyvinylchloride or polyethylene foam; closed-cell sponge of vinyl or rubber; closed cell neoprene or butyl rod; or polychloroprene tubes or beads.

#### 2.1.10.6 Bond Preventive Materials

Provide polyethylene tape with pressure-sensitive adhesive; aluminum foil or waxed paper.

#### 2.1.10.7 Preformed Sealing Compound

Provide nonskinning type conforming to [AAMA 800](#). Tapes, beads, ribbons or other shapes as required.

#### 2.1.11 Glass and Glazing

Materials are specified under Section [08 81 00](#) GLAZING.

#### 2.1.12 Firestopping Material

[Portland cement concrete of same design and strength as floor slab] [As specified in Section [03 30 00](#) CAST-IN-PLACE CONCRETE] [Mineral fiber manufactured from asbestos-free materials, and conforming to [ASTM C612](#) or [ASTM C665](#), meeting fire resistance requirements specified].

#### 2.1.13 Screens

[ASTM D3656/D3656M](#), Class 2, 18 by 14 mesh, color [charcoal] [gray] [\_\_\_\_\_].

#### 2.1.14 Paint and Finishes

See Section [09 90 00](#) PAINTS AND COATINGS, for field applied coatings.

#### 2.1.15 Panels

Maximum U-value [\_\_\_\_\_]. Where, in order to meet the requirements specified, the proposed panel assembly is thicker than indicated, make corresponding adjustments in accessories and other work such as door, window and louver frames, flashing, coping, and trim products at no extra cost to the Government. Unless otherwise indicated, design for installation from outside the building. Provide vapor barrier on interior face of insulation. Seal edges of panels with cores of absorptive material to prevent entrance of water and allow venting of the core space to outside air. Panels must comply with [ASTM E84](#) surface burning characteristics, with a flame spread index of [25] [\_\_\_\_\_] or less and a smoke developed index of [50] [450] [\_\_\_\_\_] or less tested by a Qualified Testing Agency. Identify products with appropriate markings of Applicable Testing Agency. Tempered Hardboard must conform to [AHA A135.4](#), Class 1, [\_\_\_\_\_] inch thick.

##### 2.1.15.1 Metal Facing Panels, Single Thickness

Metal facing panels must be single thickness. Panel facing must be [flat sheet] [textured] [impressed-relief] [\_\_\_\_\_] type, made of [porcelain enamel] [aluminum] [bronze] [stainless steel] and, with [backside

stiffeners] [or] [edge flanges] spaced as required to meet flatness specified. Where indicated, backup panels with [\_\_\_\_\_].

#### 2.1.15.2 Laminated Panels

Panels must be metal-faced laminated both sides, consisting of exterior metal facing, facing backing, insulating core, facing backing, and interior metal facing. Facing-panel dimensions must be as indicated.

##### 2.1.15.2.1 Exterior Metal Facing

Facing must be Porcelain-Enamel on steel. Base metal must be steel sheets for porcelain enameling, 0.010 to 0.015 inch thick, of the quality and type best suited for the work, stretcher level standard of flatness, conforming to ASTM A424/A424M, and properly precleaned and treated for adherence of the porcelain enamel.

Porcelain-enamel processing, corrosion protection, weather resistance, color retention of red, yellow, and orange porcelain enamels, continuity of coating, and surface appearance must meet or exceed the requirements specified in PEI 1001.

Color of porcelain-enamel exposed-to-view surfaces must be PEI CG-3 [\_\_\_\_\_]. Ivory (Munsell number by 8.7/3.4) and match the color of the approved samples.

Gloss of exposed-to-view surfaces must be [high] [medium] [low] reflectivity.

##### 2.1.15.2.2 Facing Backing

Nominal 1/8-inch thick, flat non-asbestos-cement sheets, flexible smooth-one-side surface finish, conforming to ASTM C220, Type F.

##### 2.1.15.2.3 Core Insulation

[ Core must be expanded perlite conforming to ASTM C610.

] [Core must be rigid urethane conforming to ASTM C591, Type 2.

] [Core must be preformed block polystyrene conforming to ASTM C578, Type II.

] [Core must be cellular glass conforming to ASTM C552.

] [Core must be mineral fiberboard conforming to [ASTM C612] [ASTM C553] [ASTM C592] [ASTM C547].

##### ] 2.1.15.2.4 Interior Metal Facing

[ Facing must be 24-gage galvanized-steel sheets conforming to ASTM A653/A653M, coating G90.

] [Facing must be as specified for exterior metal facing.

##### ] 2.1.15.2.5 Panel Fabrication

Securely bond panel materials together to form a stable and durable composite unit. Panels with core insulation of absorptive material must have edges sealed and provide venting to the outside air. Provide panels

that conform to the following:

Flatness: Provide exterior surfaces of such flatness that, when measured at room temperature, the maximum slope of the surface at any point, measured from the nominal plane of the surface, that do not exceed the following:

1.0 percent for surfaces having a finish of high reflectivity

1.25 percent for surfaces having a finish of medium reflectivity

1.5 percent for surfaces having a finish of low reflectivity

Structural requirements: Panels of the maximum size required by the work, when supported in the manner intended, must withstand the windload specified without permanent deformation or damage.

Accelerated aging: Panels must show no evidence of delamination, warpage, or other deterioration or damage after completion of six accelerated aging cycles in accordance with [ASTM C481](#), Cycle A.

Thermal transmittance: U-factor of a panel, when a panel not less than 10 square feet in area and of identical construction is tested in accordance with [ASTM C1363](#), must be as follows:

Not more than [0.10] [0.15] [0.20] [0.25] [0.30] [0.40] [0.45]  
Btu/hr-square foot-degree F.

#### 2.1.15.3 Nonmetallic Panels

- a. Provide panels that are glass-faced on the side that will be exposed to view. Glass must be spandrel glass with ceramic coating on its nonweathering surface and [smooth] [\_\_\_\_\_] finish on the exposed surface [; backing must be adhesively bonded to nonweathering surface]. Backing must be [\_\_\_\_\_] and include [galvanized steel] [\_\_\_\_\_] on surface nearest the building. Color of glass when viewed from the surface that will be exposed after installation must be [\_\_\_\_\_] . Where indicated, back up glass panels with [\_\_\_\_\_].
- b. Adhesively bonded insulated panels must be nonmetallic faced, sandwich type, [\_\_\_\_\_] [tempered hardboard] on exposed face and on nonexposed face. Apply coating of [epoxy] [polyester] [\_\_\_\_\_] followed by application of [inert aggregate] [\_\_\_\_\_] to exposed face in the [factory] [field]. [Inert aggregate] [\_\_\_\_\_] must be [natural stone chips] [crushed marble] [\_\_\_\_\_] [with minimum and maximum sizes of [\_\_\_\_\_] and [\_\_\_\_\_]]. Color of [\_\_\_\_\_] must be [\_\_\_\_\_].
- c. Nonmetallic panels, [\_\_\_\_\_] surfaced: [\_\_\_\_\_] [tempered hardboard] [\_\_\_\_\_] board base with applied [factory] [or] [field] finish of [[\_\_\_\_\_] resins and decorative natural stone chips] [\_\_\_\_\_] . Apply [epoxy] [polyester] coating of [\_\_\_\_\_] followed by application of [inert aggregate] [\_\_\_\_\_] to exposed face in the [factory] [field]. [Inert aggregate] [\_\_\_\_\_] must be [natural stone chips] [crushed marble] [\_\_\_\_\_] [with minimum and maximum sizes of [\_\_\_\_\_] and [\_\_\_\_\_]]. Color of [\_\_\_\_\_] must be [\_\_\_\_\_].

#### 2.1.16 Metal Windows

[Fixed] [Operating] [Fixed and operating]. Comply with requirements of



[\_\_\_\_], [Steel] [Aluminum] Windows [\_\_\_\_] [AAMA/WDMA/CSA 101/I.S.2/A440] [SWI AGSW] as modified herein. Provide inside glazing with removable metal glazing beads [except for windows having structural gaskets]. Comply with glass clearance dimensions and sealant dimensions recommended by glass manufacturer.

#### 2.1.16.1 Frames

Frames for fixed glazed panels and window units must be [aluminum] [bronze] [stainless steel] [steel].

#### 2.1.16.2 Operating Windows

Operating windows must be [double-hung] [projected] [horizontally pivoted] [vertically pivoted] [top-hinged inswinging] [horizontal sliding] [casement] [\_\_\_\_] type. [Operating windows must be complete with hardware, weatherstripping, and accessories.] Hardware must comply with [AAMA/WDMA/CSA 101/I.S.2/A440] [SWI AGSW] modified as follows:

- a. Metal and finish for hardware must be [\_\_\_\_].
- b. [\_\_\_\_].

#### 2.1.16.3 Window Construction

Weld or mechanically join and seal corners of frames and ventilators for water-tight construction. Remove excess metal from welded joints and dress smooth on exposed and contact surfaces so that no objectionable discoloration or roughness will be visible after finishing. Apply sealing compound in interior surfaces of corners and frame intersections.

#### [2.1.17 Insect Screens

Provide insect screens for ventilators of [\_\_\_\_] windows [\_\_\_\_] in accordance with [\_\_\_\_], [Steel] [Aluminum] Windows [\_\_\_\_] [AAMA/WDMA/CSA 101/I.S.2/A440] [SWI AGSW]. Screens for double-hung windows must be [full length, top-hung type] [double vertical sliding type] [half-length fixed type]. Screens for [projected] [casement] [\_\_\_\_] windows must be [\_\_\_\_] type. Mount screens on [inside] [outside] of windows. Screens must be rewirable, easily removable from inside the building, and interchangeable for same size ventilators of similar type windows. Provide hardware, guides, stops, clips, bolts, and screws as necessary for a secure and tight attachment to window. [ Where sliding or hinged wickets are required in screens to permit operation of window hardware, the frame around the wicket opening must be of similar material and strengths as the screen frames.]

- a. Frames: Construct screen frames of similar material and finish as specified for the windows to which attached. Screen frame construction must consist of closed tubular shapes standard with the manufacturer, either extruded or roll formed. Frames must be mitered, electrically flash welded, then dressed smooth; or have internal reinforcing or blocks at corners and mechanically connected corners. Screen frames must have removable splines of aluminum, stainless steel, or vinyl.
- b. Screening: Weave of screening must be parallel with frames and sufficiently tight to present a smooth appearance. Conceal edges of screening in spline channel of frames.

- c. Hardware: Screen hardware must be manufacturer's standard type and finish, unless otherwise indicated.

#### ]2.1.18 Metal Accessories

[Gravel stops and fascias,] [Flashings,] [Metal sills,] [Metal stools,] [Louvers,] [Venetian blind pockets,] [Closures,] [and soffits] [\_\_\_\_\_]. Fabricate accessories of sizes and shapes indicated from similar materials and finish as specified for wall system.

## 2.2 METALS FOR FABRICATION

### 2.2.1 Aluminum-Alloy Extrusions

Extrusions must conform to [ASTM B221](#).

Extrusions to receive an integral-color anodic coating must be the alloy and temper recommended by the aluminum producer for the specified finish with integral-color anodic coating and have mechanical properties equal to or exceeding those of [ASTM B221](#) 6063-T5.

### 2.2.2 Aluminum-Alloy Sheets and Plates

Unless otherwise specified, sheets and plates must conform to [ASTM B209](#), Alloy 3003-H16.

Sheets and plates to receive a clear anodic coating must conform to [ASTM B209](#), Alloy 5005-H16.

Sheets and plates to receive an integral-color anodic coating must be the alloy and temper recommended by the aluminum producer for the specified coating and have mechanical properties equal to or exceeding those of 5005-H16.

### 2.2.3 Structural Steel

Hot-rolled shapes, plates, and bars must conform to [ASTM A36/A36M](#).

Hot-formed tubing must conform to [ASTM A501/A501M](#).

Sheet and strip for cold-formed, light-gage, structural members must conform to [ASTM A1011/A1011M](#).

### 2.2.4 Metals for Fasteners

Provide aluminum-alloy bolts and screws made from rod conforming to [ASTM B211/B211M](#), Alloy 2024-T351.

Provide aluminum-alloy nuts made from rod conforming to [ASTM B211/B211M](#), Alloy 6061-T6.

Provide aluminum-alloy washers made from sheet conforming to [ASTM B209](#), [ASTM B211/B211M](#), Alloy 2024-T4.

Provide aluminum-alloy rivets made from rod or wire conforming to [ASTM B316/B316M](#), Alloy 6053-T61.

Provide steel fasteners made from corrosion-resistant chromium-nickel Type 302, 303, 304, 305, or 316 with the form and condition best suited for the

work.

### 2.3 NONSKINNING SEALING COMPOUND

Sealing compound must be nonskinning, gun-grade type conforming to [AAMA 800](#).

### 2.4 FABRICATION

#### 2.4.1 Workmanship

[Metal Accessories](#) must be accurately formed; joints, except those designed to accommodate movement, accurately fitted and rigidly assembled.

Insofar as practical, fitting and assembly of the work must be done in the manufacturer's plant. Mark work that cannot be permanently factory-assembled before shipment to ensure proper assembly at the site.

#### 2.4.2 Shop-Painting Aluminum

Shop prime aluminum surfaces that will come in contact with dissimilar metals, masonry, concrete, or wood.

Prepare aluminum surfaces for painting in accordance with [ASTM D1730](#), Type B, Method 2 or 3.

Give aluminum surfaces one shop coat of paint applied to dry, clean, surfaces to provide a continuous minimum dry-film thickness of [1.5 mils](#).

#### 2.4.3 Shop-Painting Steel

Shop prime surfaces of concealed steel.

Remove scale, rust, and other deleterious materials. Remove heavy rust and loose mill scale in accordance with [SSPC SP 3](#) or [SSPC 7/NACE No.4](#). Remove oil, grease, and similar contaminants in accordance with [SSPC SP 1](#).

Give steel surfaces two coats of paint; the second coat must have a color different from the first coat. Apply paint to dry, clean, surfaces to provide a continuous minimum dry-film thickness of [1.5 mils](#) for the first coat and [1 mil](#) for the second coat.

#### 2.4.4 Depth of Glazing Rabbets

Depth of glazing rabbets for openings to receive glass materials or panels must be as follows:

<u>MATERIAL</u>	<u>NOMINAL THICKNESS</u>	<u>MAXIMUM SIZE</u>	<u>MINIMUM RABBET DEPTH</u>
Single-glass lights	Double strength	Up to 5 square feet	3/8 inch
	Double strength	Over 5 square feet	1/2 inch
	1/8 inch	Up to 5 square feet	3/8 inch
	1/8 inch	5 to 25 square feet	1/2 inch
	1/8 inch	25 to 70 square feet	5/8 inch
	3/16 inch	Up to 25 square feet	1/2 inch
	3/16 inch	Over 25 square feet	5/8 inch
	7/32 inch	All sizes	5/8 inch
	1/4 inch	Up to 100 square feet	5/8 inch
	1/4 inch	Over 100 square feet	3/4 inch
	5/16 inch	All sizes	3/4 inch
	3/8 inch	All sizes	7/8 inch
	1/2 inch	All sizes	7/8 inch
	3/4 inch	All sizes	7/8 inch
	Double-glazing units	All thicknesses	Up to 25 square feet
All thicknesses		25 to 70 square feet	3/4 inch
Panels	Up to 1 inch	All sizes	5/8 inch
	1 to 1-1/2 inches	All sizes	3/4 inch

[2.4.5 Anodic Finish

The following designation of finishes refer to standard finishes as defined in the NAAMM AMP 500. Exposed-to-View Aluminum Finish of surfaces must be:

[

] [Frosted finish with Class II clear anodic coating: Medium-matte chemical etch and Architectural Class II (0.4- to 0.7-mil thickness) anodic coating producing a natural aluminum color. Finish must be AA C22-A31 in accordance with AA DAF45.

] [Frosted finish with Class I clear anodic coating: Medium-matte chemical etch and Architectural Class I (0.7-mil and greater thickness) anodic coating producing a natural aluminum color. Finish must be AA C22-A41 in accordance with AA DAF45.

] [Polished frosted finish with Class II clear anodic coating: Smooth specular-buffed mechanical, followed by a medium-matte chemical etch and Architectural Class II (0.4- to 0.7-mil thickness) anodic coating producing a natural aluminum color. Finish must be AA M21-C22-A31 in accordance with AA DAF45.

] Polished frosted finish with integral-color anodic coating: Smooth specular buffed mechanical, followed by nonetching inhibitive alkaline cleaning, medium-matte chemical etch, and Architectural Class I ( 0.7-mil and greater thickness) anodic coating producing an integral-color finish. Color must be:

[Light bronze] [Medium bronze] [Dark bronze] [Black]

Match aluminum-finish color and appearance to that of the sample approved for use in the project within the aluminum producer's standard color range.

Test the anodic coating on aluminum for thickness in accordance with ASTM B244.

Test anodically coated aluminum for the weight of the coating in accordance with ASTM B137.

Test the resistance of anodically coated aluminum to staining by dyes in accordance with ASTM B136.

#### ] [2.4.6 Pigmented Organic Coating

Curtain wall framing exposed to view to be [ a pigmented organic coating complying with AAMA 2603] [ a high-performance organic coating complying with AAMA 2604] [ a superior performing organic coating complying with AAMA 2605] Color: [\_\_\_\_\_].

#### ] 2.5 CURTAIN-WALL FRAMING MEMBERS

##### 2.5.1 General

Framing members must be thermally broken and be the section dimensions and arrangement indicated and designed to accommodate windows, panels, and other materials to be incorporated into the curtain-wall system.

[ Curtain-wall framing must be the vertical mullion type with the vertical mullions extending the indicated distance beyond the exterior face of the curtain wall.

] [Curtain-wall framing must be the grid type with both the vertical and horizontal mullions extending the indicated distance beyond the exterior face of the curtain wall.

##### ] 2.5.2 Construction

Framing members must be aluminum-alloy extrusions with a wall thickness not less than 0.125 inch. Glazing rabbet legs must be an integral part of the frame with the leg depth not less than the minimum depth specified for the thickness and size of the glass material or panel to be installed in the curtain-wall frame. Design and construct frames to receive window sash and louvers of the type specified when required.

Prepare vertical mullions for anchorage to the building construction at the

bottom, at each intermediate floor elevation, and at the top.

[ Corners of frames must be mortise-and-tenon construction except that the corners of the vertical and horizontal mullions in grid frames must be coped-and-welded construction. Welds must be on the unexposed surfaces. Corner joints must be accurately fitted and flush, with watertight hairline joints not exceeding 1/64 inch in width. Apply nonskinning sealing compound to the unexposed surfaces of all mortise-and-tenon joints.

] [Corners of frames must be coped and welded construction. Welds must be on the unexposed surfaces. Corner joints must be accurately fitted and flush, with watertight hairline joints not exceeding 1/64 inch in width.

## ] 2.6 ALUMINUM DOORS AND FRAMES

Aluminum doors and frames are specified in Section 08 11 16 ALUMINUM DOORS AND FRAMES.

## 2.7 METAL ACCESSORIES

### 2.7.1 Sills

Sills must be the shapes and dimensions indicated and fabricated of aluminum-alloy extrusions having a wall thickness not less than 0.125 inch.

Sills must run continuously under the curtain wall and permit the lower curtain wall frame member to interlock without fastenings.

### 2.7.2 Coping

Coping must be the shapes and dimensions indicated and welded mitered inside and outside corner sections, concealed cover plates, and other components as required for the installation.

Coping-system components must be aluminum-alloy extrusions with wall thicknesses of 0.05 inch, minimum.

### 2.7.3 Exterior Architectural Louvers

Exterior architectural louvers are specified in Section 05 72 00 DECORATIVE METAL SPECIALTIES.

## [ 2.8 SUN CONTROL

Provide [sunshades] [ and ] [light shelves] in accordance with the following:

### 2.8.1 Sunshades

Assemblies consisting of manufacturer's standard outrigger brackets, louvers, and fascia, designed for attachment to curtain wall with mechanical fasteners.

- a. Orientation: [Horizontal] [Vertical].
- b. Projection from Wall: [As indicated on Drawings] [20] [25] [30] [35] [\_\_\_\_\_] inches.
- c. Outriggers: [Straight with square edges] [Straight with rounded edge] [Curved] [Wedge] <Insert shape>.

## d. Louvers:

(1) Number: [Three] [Four] [Five] [\_\_\_\_\_] louvers per unit.

(2) Shape: [Planar] [Arched] [Circular] [Airfoil] [Square].

(3) Width: [6] [8] [10] [\_\_\_\_\_] inches.

(4) Mounting Angle: [25] [30] [35] [\_\_\_\_\_] degrees.

## e. Fasciae: [Rectangular] [Bullnose] [Angular] [Circular].

## f. Finish: [Match adjacent glazed aluminum curtain wall] &lt;Insert finish&gt;.

## g. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

## h. Steel Reinforcement: As required by manufacturer.

## 2.8.2 Light Shelves

Light-reflecting assemblies consisting of manufacturer's standard support brackets or channels, and aluminum tray, designed for attachment to interior of curtain wall with mechanical fasteners.

## a. Projection from Wall: [As indicated on Drawings] [20] [25] [30] [35] [\_\_\_\_\_] inches.

## b. Finish: [Match adjacent glazed aluminum curtain wall] [\_\_\_\_\_].

## c. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

## d. Steel Reinforcement: As required by manufacturer.

## ]2.9 THERMAL INSULATION MATERIALS

Thermal insulation materials are specified in [Section 07 21 16 MINERAL FIBER BLANKET INSULATION] [Section 07 21 13 BOARD AND BLOCK INSULATION] [Section 07 21 23 LOOSE FILL THERMAL INSULATION] [Section 07 24 00 EXTERIOR INSULATION AND FINISH SYSTEMS] [\_\_\_\_\_].

## 2.10 SEALANTS AND CAULKINGS

Sealants and caulking are specified in Section 07 92 00 JOINT SEALANTS.

## 2.11 CURTAIN-WALL INSTALLATION MATERIALS

## 2.11.1 Threaded Concrete Inserts

Galvanized ferrous castings with enlarged bases with not less than two nailing lugs, length as indicated, internally threaded 3/4-inch diameter machine bolt must conform to ASTM A47/A47M, Grade [32510] [35018] [Grade 22010] or ASTM A27/A27M, Grade U-60-30, and hot-dip galvanized in accordance with ASTM A153/A153M.

## 2.11.2 Wedge Concrete Inserts

Galvanized, box-type, ferrous castings with an integral loop at the back of the box and designed for 3/4-inch diameter bolts with wedge-shaped heads must conform to ASTM A47/A47M, Grade [32510] [35018] or ASTM A27/A27M, Grade U-60-30, and hot-dip galvanized in accordance with ASTM A153/A153M.

Carbon steel bolts with wedge-shaped heads, nuts, washers, and shims must be hot-dip galvanized in accordance with ASTM A153/A153M.

#### 2.11.3 Slotted Concrete Inserts

Galvanized pressed-steel plate, welded construction, box type with a slot designed for 3/4-inch diameter square-head bolts to provide lateral adjustment must be 1/8-inch minimum thickness, conforming to ASTM A283/A283M, Grade C, hot-dip galvanized in accordance with ASTM A123/A123M. Length of the insert body less anchorage lugs must be 6 inches minimum and provided with a knockout cover.

#### 2.11.4 Masonry Anchorage Devices

#### 2.11.5 Toggle Bolts

Toggle bolts must be the tumble-wing type.

#### 2.11.6 Steel Bolts, Nuts, and Washers

Bolts must be regular hexagon head, low-carbon steel.

Nuts must be hexagon, regular style, carbon steel.

Plain washers must be round, general-assembly purpose, carbon steel.

Lockwashers must be helical spring, carbon steel.

#### 2.11.7 Machine Screws

Provide screws for concealed work that are corrosion-resistant steel, slotted or cross-recessed type, roundhead.

Provide screws for exposed-to-view work that are corrosion-resistant steel, cross-recessed, flathead.

#### 2.11.8 Electrodes for Welding Steel

Electrodes for welding steel by the manual shielded metal arc welding process must meet the requirements of AWS D1.1/D1.1M and be covered mild-steel electrodes conforming to AWS A5.1/A5.1M, E60 series.

### PART 3 EXECUTION

#### 3.1 GENERAL

Install curtain walls and accessories in accordance with the approved drawings and as specified.

#### 3.2 FABRICATION

Provide curtain wall components of the materials and thickness indicated or specified. The details indicated are representative of the required design and profiles. Acceptable designs may differ from that shown if the



proposed system components conform to the limiting dimensions indicated and the requirements specified herein. Unless specifically indicated or specified otherwise, the methods of fabrication and assembly must be at the discretion of the curtain wall manufacturer. Perform fitting and assembling of components in the shop to the maximum extent practicable. Provide anchorage devices with adjustment capability in three directions. Exposed fastenings used on finished surfaces must be truss head, flat head, or oval head screws or bolts.

### 3.2.1 Joints

Provide welded or mechanical fasteners as indicated or specified. Match joints in exposed work to produce continuity of line and design. Bed-joints or rabbets receiving caulking or sealing material must be minimum  $3/4$  inch deep and  $3/8$  inch wide at mid ambient temperature range.

### 3.2.2 Welding

Conform to [AWS D1.1/D1.1M](#). Use methods and electrodes recommended by manufacturers of base metal alloys. Provide welding rods of an alloy that matches the color of the metal being welded. Protect glass and other finish from exposure to welding spatter. Ground and finish weld beads on exposed metal surfaces to minimize mismatch and to blend with finish on adjacent parent metal. If flux is used in welding aluminum, completely remove it immediately upon completion of welding operations. Do not use exposed welds on aluminum surfaces.

### 3.2.3 Soldering and Brazing

Provide as recommended by suppliers. Solder only for filling or sealing joints.

### 3.2.4 Ventilation and Drainage

Provide internal ventilation and drainage system of weeps based on principles of pressure equalization to ventilate the wall internally and to discharge condensation and water leakage to exterior as inconspicuously as possible. Flashings and other materials used internally must be nonstaining, noncorrosive, and nonbleeding.

### 3.2.5 Protection and Treatment of Metals

#### 3.2.5.1 General

Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving the shop.

#### 3.2.5.2 Galvanic Action

Provide protection against galvanic action wherever dissimilar metals are in contact, except in the case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

#### 3.2.5.3 Protection for Aluminum

Protect aluminum which is placed in contact with, built into, or which will

receive drainage from masonry, lime mortar, concrete, or plaster with one coat of alkali-resistant bituminous paint. Where aluminum is contacted by absorptive materials subject to repeated wetting or treated with preservative noncompatible with aluminum, apply two coats of aluminum paint, to such materials and seal joints with approved caulking compound.

### 3.3 INSTALLATION

Installation and erection of glazed wall system and all components must be performed under direct supervision of and in accordance with approved recommendations and instructions of wall system manufacturer or fabricator.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

#### 3.3.1 Bench Marks and Reference Points

Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of the marks, stop erection work in that area until discrepancies have been corrected.

#### 3.3.2 Verifying Conditions and Adjacent Surfaces

After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in the building frame.

#### 3.3.3 Materials Embedded In Other Construction

Install materials to be embedded in cast-in-place concrete and masonry prior to the installation of the curtain wall. Provide setting drawings, templates, and instructions for installation.

#### 3.3.4 Fastening To Construction-In-Place

Provide anchorage devices and fasteners for fastening work to construction-in-place. Provide fasteners as specified.

#### 3.3.5 Setting Masonry Anchorage Devices

Set devices in masonry or concrete-in-place construction in accordance with the manufacturer's printed instructions. Leave drilled holes rough and free of drill dust.

#### 3.3.6 Field-Welding Steel And Touchup Painting

Procedures of manual shielded metal arc welding, the appearance and quality of the welds made, and the methods used in correcting welding work must conform to [AWS D1.1/D1.1M](#).

After completion of welding, clean and paint field welds and scarred surfaces on steel work and on adjacent ferrous-metal surfaces. Paint must be the same as that used for shop painting.

#### 3.3.7 Installation Tolerances

Install curtain walls within the following tolerances:

Deviation in location from that indicated on the drawings	Plus or minus 1/4 inch
Deviation from the plumb or horizontal	
In 12 feet of length	Not more than 1/8 inch
In any total length	Not more than 1/2 inch
Offset from true alignment at joints between abutting members in line	Not more than 1/16 inch

### 3.3.8 Placing Curtain-Wall Framing Members

Install members plumb, level, and within the limits of the installation tolerances specified.

Connect members to building framing. Provide supporting brackets adjustments for the accurate location of curtain-wall components. Adjustable connections must be rigidly fixed after members have been positioned.

### 3.3.9 Panel Installation

Panels must be set with a glazing-tape back bed, two-component elastomeric sealing-compound heel bead, glazing-tape bedding of the stop, and two-component elastomeric sealing-compound topping bead on both sides of the panel. Face and edge clearances must not be less than 1/8 inch. Remove excess sealing compound on both sides of the curtain wall opening with a glazing knife at a slight angle over the rabbet leg or applied stop. Install applied stops on the exterior side of the curtain wall and secured with screws.

### 3.3.10 Panels

Install panels [in framing member openings] [into framed pre-assembled units] [\_\_\_\_\_] using [sealants] [gaskets] [gaskets and sealants] [\_\_\_\_\_] as indicated or specified.

### 3.3.11 Windows

Install windows in accordance with details indicated and approved detail drawings.

#### 3.3.11.1 Sealing

Seal exterior metal to metal joints between members of windows, frames, mullions, and mullion covers. Remove excess sealant.

#### 3.3.11.2 Ventilators and Hardware

After installing and glazing windows, adjust ventilators and hardware to operate smoothly and to be weathertight when ventilators are closed and locked. Lubricate hardware and moving parts.

#### 3.3.11.3 Weatherstripping

Install to make weathertight contact with frames when ventilators are closed and locked. Do not cause binding of sash or prevent closing and locking of ventilator.

Provide for ventilating sections of all windows to insure a weather-tight seal meeting the infiltration tests specified. Use easily replaceable factory-applied weatherstripping of manufacturer's stock type. Use molded vinyl, molded or molded-expanded neoprene for weatherstripping for compression contact surfaces. For sliding surfaces, use treated woven pile or wool, polypropylene or nylon pile with nylon fabric and metal or plastic backing strip weatherstripping. Do not use neoprene or polyvinyl chloride weatherstripping where they will be exposed to direct sun light.

### 3.3.12 Joint Sealants

#### 3.3.12.1 Surface Preparation

Surfaces to be primed and sealed must be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions must conform to approved detail drawings with a tolerance of plus 1/8 inch. Do not apply compound unless ambient temperature is between 40 and 90 degrees F. Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings must be of type that leave no residue on metals.

#### 3.3.12.2 Applications

Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound must be uniformly smooth and free of wrinkles and, unless indicated otherwise, tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, not to exceed 5 gallons at any given time.

#### 3.3.12.3 Primer

Apply to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.

#### 3.3.12.4 Backing

Tightly pack in bottom of joints which are over 1/2 inch in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

#### 3.3.12.5 Bond Prevention

Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.

#### 3.3.12.6 Protection and Cleaning

Remove compound smears from surfaces of materials adjacent to sealed joints

as the work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave the work in clean neat condition.

### 3.3.13 Glass

Install in accordance with [insulating glass](#) manufacturer's recommendations as modified herein. [ Install insulating glass units made with heat absorbing glass with heat absorbing pane on exterior side.]

#### 3.3.13.1 Inspection of Sash and Frames

Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

#### 3.3.13.2 Preparation of Glass and Rabbets

Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer.

#### 3.3.13.3 Positioning Glass

Set glass from inside the building unless otherwise indicated or specified. Maintain specified edge clearances and glass bite at perimeter. Maintain position of glass in rabbet and provide required sealant thickness on both sides of glass. For glass dimensions larger than [50 united inches](#), provide setting blocks at sill and spacer shims on all four sides; locate setting blocks one quarter way in from each jamb edge of glass. Where setting blocks and spacer shims are set into glazing compound or sealant, butter with compound or sealant, place in position, and allow to firmly set prior to installation of glass.

#### 3.3.13.4 Setting Methods

Apply glazing compound, glazing sealant, glazing tape, and gaskets uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners, and solvents. Strip surplus compound from both sides of glass and tool at slight angle to shed water and provide clean sight lines. Secure stop beads in place with suitable fastenings. Do not apply compound or sealant at temperatures lower than [40 degrees F](#), or on damp, dirty, or dusty surfaces. After glazing, fix ventilators in sash so they cannot be operated until compound or sealant has set.

- a. Use sealant glazing to completely fill channel on edges and on both sides of glass for [\_\_\_\_\_].
- b. Use sealant and tape glazing, with glazing sealant for cap bead above glazing tape against fixed exterior stops and glazing tape full height against removable interior stops for [\_\_\_\_\_].
- c. Use sealant and tape glazing, with glazing sealant full height against

removable exterior stops with heel bead or glazing sealant and glazing tape full height against fixed interior stops for [\_\_\_\_\_].

- d. Use sealant and tape glazing, with glazing sealant cap beads above glazing tape against both exterior and interior stops for [\_\_\_\_\_]. Removable stops may be on either exterior or interior side of glass.
- e. Use tape, sealant, and compound glazing, with glazing tape full height against fixed exterior stops, glazing compound as a cap bead above heel bead sealant and against removable interior stops for [\_\_\_\_\_].
- f. Use tape, sealant, and gasket glazing, with glazing tape full height against fixed exterior stops, glazing sealant as a heel bead at edge of glass, and preformed vision strip gasket against removable interior snap-on stops for [\_\_\_\_\_].
- g. Use compression gasket glazing, with compression gaskets both sides of glass and adjustable or snap-on interior stops for [\_\_\_\_\_].
- h. Use lock-strip gasket glazing, with lock-strip glazing gaskets for [\_\_\_\_\_]. Install gaskets in accordance with manufacturer's instructions using special tools and lubricants. When lock-strip type gaskets are used for glazing insulating glass units, follow glass manufacturer's recommendations regarding horizontal wall supports between vertical units, setting blocks, weep holes, and the use of supplementary wet sealants.

#### 3.3.13.5 Void Space

Heat absorbing, insulating, spandrel, and tempered glass, and glass of other types that exceed 100 united inches in size: Provide void space at head and jamb to allow glass to expand or move without exuding the sealant.

#### 3.3.13.6 Insulating Glass

Provide adequate means to weep incidental water and condensation away from the sealed edges of insulated glass units and out of the wall system. The weeping of lock-strip gaskets must be in accordance with the recommendation of the glass manufacturer.

#### 3.3.13.7 Insulating Glass With Edge Bands

Insulating glass with flared metal edge bands set in lock-strip type gaskets: Follow glass manufacturer's recommendations and add supplementary wet seal as required; when used with glazing tape, use tapered tape.

#### 3.3.14 Firestopping

Provide firestopping [, where indicated,] in openings between wall system and floor at each story to prevent passage of flame and hot gases from floor to floor under extended fire exposure. Installed fire stopping must remain in place under extended fire exposure despite distortions that may occur in wall system components. Securely attach anchoring or containment devices to building structure and not to wall system. Place [concrete] [mineral fiber] [\_\_\_\_\_] on [steel plates attached to bottom of floor slab] [impaling chips embedded in edge of floor slab] [\_\_\_\_\_].

#### 3.3.15 Field Applied Insulation

Provide insulation with minimum R-value of [\_\_\_\_], on clean, dry, properly prepared surfaces of [masonry] [concrete] [\_\_\_\_] back-up wall in accordance with [\_\_\_\_] INSULATION using approved accessories and methods as recommended by insulation manufacturer unless indicated or specified otherwise. Cover and protect each day's application until protection is provided by completed work.

### 3.4 FINISHES

#### 3.4.1 Galvanizing

Conform to [ASTM A123/A123M](#), [ASTM A153/A153M](#), and [ASTM A653/A653M](#), as applicable.

##### 3.4.1.1 Repair of Zinc-Coated Surfaces

Repair zinc coated surfaces damaged by welding or other means with galvanizing repair paint or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved.

#### 3.4.2 Shop Cleaning and Painting

##### 3.4.2.1 Cleaning

Clean steel and iron work by power wire brushing or other approved manual or mechanical means, for removal of rust, loose paint, scale, and deleterious substances. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other foreign matter, with solvents until thoroughly clean in accordance with [SSPC SP 12/NACE No.5](#). Cleaning steel embedded in concrete is not required.

##### 3.4.2.2 Painting Steel or Iron Surfaces

[Apply one coat of primer.] [Apply primer to a minimum dry film thickness of 1.0 mil.] Apply additional shop coat of specified paint, to which a small amount of tinting material has been added, on surfaces that will be concealed in the finished construction or that will not be accessible for finish painting. Accomplish painting in dry weather or under cover, and on steel or iron surfaces that are free from moisture and frost. Do not paint surfaces of items to be embedded in concrete. Recoat damaged surfaces upon completion of work. Prime coat steel immediately after cleaning. Do not apply bituminous protective coatings to items to be finish painted.

##### 3.4.2.3 Painting Weathering Steel

Clean and paint surfaces which will not be exposed to the weather with one shop or field coat of specified primer, or other approved rust-inhibitive primer. Clean and strip-paint weathering steel contact surface to be covered by structural or compression gaskets or sealants with one coat to insure positive seal.

### 3.5 FIELD TESTS

Notify the Contracting Officer a minimum of seven calendar days prior to performing field tests. Conduct field check test for water leakage on designated wall areas after erection. Conduct test on [two] [\_\_\_\_] wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as described in [AAMA 501.1](#).

### 3.6 CLEANING AND PROTECTION

#### 3.6.1 General

At the completion of the installation, clean the work to remove mastic smears and other foreign materials.

#### 3.6.2 Manufacturer's Information

[Preventive Maintenance and Inspection](#) must consist of the aluminum manufacturer's recommended cleaning materials and application methods, including detrimental effects to the aluminum finish when improperly applied.

#### 3.6.3 Glass

Upon completion of wall system installation, thoroughly wash glass surfaces on both sides and remove labels, paint spots, putty, compounds, and other defacements. Replace cracked, broken, and defective glass with new glass at no additional cost to the Government.

#### 3.6.4 Aluminum Surfaces

Protection methods, cleaning, and maintenance must be in accordance with [AAMA 609 & 610](#).

#### 3.6.5 Other Metal Surfaces

After installation, protect windows, panels, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods must be in accordance with recommendations of product manufacturers or of the respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or the respective trade association.

#### 3.6.6 Porcelain-Enamel Surfaces

Wash surfaces with clean water and soap and rinsed with clean water. Do not use acid solutions, steel wool, or other harsh abrasives.

### 3.7 INSPECTION AND ACCEPTANCE PROVISIONS

#### 3.7.1 Finished Curtain-Wall System Requirements

Curtain-wall work which contains any of the following deficiencies, is unacceptable, and will be rejected:

Finish of exposed-to-view aluminum having color and appearance that are outside the color and appearance range of the approved samples.

Installed curtain-wall components having stained, discolored, abraded, or otherwise damaged exposed-to-view surfaces that cannot be cleaned or



repaired.

Aluminum surfaces in contact with dissimilar materials that are not protected as specified.

### 3.7.2 Repair of Defective Work

Remove and replace defective work with curtain-wall materials that meet the specifications at no expense to the Government.

-- End of Section --

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## SECTION 08 51 13

## ALUMINUM WINDOWS

05/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 701/702 (2011) Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals

AAMA 901 (2016) Voluntary Specification for Rotary & Linear Operators in Window Applications

AAMA 902 (2016) Voluntary Specification for Sash Balances

AAMA 907 (2015) Voluntary Specification for Corrosion Resistant Coatings on Carbon Steel Components Used in Windows, Doors and Skylights

AAMA 1302.4 (1973) Specifications for Forced-Entry Resistant Aluminum Prime Windows

AAMA 1503 (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (2017a) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic

	Coatings on Aluminum Extrusions and Panels
AAMA WSG.1	(1995) Window Selection Guide
AAMA/WDMA/CSA 101/I.S.2/A440	(2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)	
ASHRAE 169	(2013) Climate Data for Building Design Standards
ASTM INTERNATIONAL (ASTM)	
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM D3656/D3656M	(2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E413	(2022) Classification for Rating Sound Insulation
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E1332	(2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass
ASTM F2912	(2017) Standard Specification for Glazing

and Glazing Systems Subject to Airblast Loadings

INTERNATIONAL WINDOW CLEANING ASSOCIATION (IWCA)

IWCA I-14.1 (2001) Window Cleaning Safety Standard

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2020) Procedure for Determining Fenestration Product U-Factors

NFRC 200 (2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2021) Life Safety Code

PASSIVE HOUSE INSTITUTE - US (PHIUS)

PHIUS Certified Certified Data Program for Window Performance

PASSIVE HOUSE INSTITUTE INTERNATIONAL (PHI)

Passivhaus Certified (2012) Certification of Passive House Suitable Components

Passivhaus Criteria (2012) Certification Criteria for Certified Passive House Glazings and Transparent Components

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA 1004 (1987; R 1998) Aluminum Tubular Frame Screens for Windows

SMA 1201 (R 2013) Specifications for Insect Screens for Windows, Sliding Doors and Swinging Doors

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01 (2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a

code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G[, [\_\_\_\_\_]]

Fabrication Drawings

SD-03 Product Data

Windows; G[, [\_\_\_\_\_]]

[ Recycled Content of Aluminum Windows; S

] Hardware; G[, [\_\_\_\_\_]]

Fasteners; G[, [\_\_\_\_\_]]

Window Performance; G[, [\_\_\_\_\_]]

Thermal-Barrier Windows; G[, [\_\_\_\_\_]]

Mullions; G[, [\_\_\_\_\_]]

Window Cleaners' Bolts; G[, [\_\_\_\_\_]]

Screens; G[, [\_\_\_\_\_]]

Weatherstripping; G[, [\_\_\_\_\_]]

Accessories; G[, [\_\_\_\_\_]]

Adhesives

Thermal Performance; G[, [\_\_\_\_\_]]

Energy Star Label For Residential Aluminum Window Products; S

SD-04 Samples

Finish Sample

Window Sample

[ Window Mock-Ups; G[, [\_\_\_\_\_]]

] SD-05 Design Data

Structural Calculations for Deflection; G[, [\_\_\_\_\_]]

Design Analysis; G[, [\_\_\_\_\_]]

SD-06 Test Reports

Minimum Condensation Resistance Factor

[ Resistance to Forced Entry

] [ Standard Airblast Test; G[, [\_\_\_\_\_]]

] [ Windborne-Debris-Impact Performance

] SD-07 Certificates

[ Engineer's Qualifications

] SD-10 Operation and Maintenance Data

Windows, Data Package 1; G[, [\_\_\_\_\_]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Plastic Identification

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualification of Manufacturer

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of [\_\_\_\_\_] years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

#### 1.3.2 Shop Drawing Requirements

Take field measurements prior to preparation of drawings and fabrications. Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attaching screens,] [material and method of attaching subframes,] [stools,] [casings,] [sills,] [trim,] [window cleaner anchors,] installation details, and other related items.

#### [1.3.3 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

#### ]1.3.4 Sample Requirements

##### 1.3.4.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

##### 1.3.4.2 Window Sample Requirements

[ Submit one full-size window of each type proposed for use, complete with AAMA Label, glazing, hardware, anchors, and other accessories. Where screens or weatherstripping is required, fit sample windows with such items

that are to be used. After approval, install each sample in work, clearly identified, and record its location.

] [Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

] [1.3.4.3 **Mock-Ups**

Before fabrication, full-size mock-up of [each type of aluminum window] [one window unit] [\_\_\_\_\_] complete with glass and AAMA certification label for structural purposes and NFRC Temporary and Permanent Label for certification of thermal performance rating will be required for review of window construction and quality of hardware operation.

] 1.3.5 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements [ and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations.

Submit **design analysis** with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure [.] [meets the requirements of paragraph ANTITERRORISM PERFORMANCE REQUIREMENTS.] Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

1.3.6 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to **AAMA/WDMA/CSA 101/I.S.2/A440** including test size, [and **minimum condensation resistance factor** (CRF) [, and **resistance to forced entry**] [, and, for Antiterrorism windows, in lieu of a Design Analysis, results of a Standard Airblast Test]. [ For Antiterrorism windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shock tube, must be included in a test report, providing information in accordance with **ASTM F1642/F1642M**, as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph STANDARD AIRBLAST TEST METHOD.]

1.3.7 Certification

Ensure that construction is performed with products that meet or exceed [ **Energy Star** criteria,] [FEMP Designated criteria,] [and **Passivhaus Criteria**] [ **Passivhaus Certified**] [and be current in their certification]. [ Provide **PHIUS Certified** window performance.]

Each prime window unit must bear the AAMA Label warranting that the product complies with **AAMA/WDMA/CSA 101/I.S.2/A440**. Certified test reports attesting that the prime window units meet the requirements of **AAMA/WDMA/CSA 101/I.S.2/A440**, including test size, will be acceptable in lieu of product labeling.



#### 1.4 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

#### 1.5 PLASTIC IDENTIFICATION

Label plastic products provided to indicate their polymeric composition according to the following list. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.

- a. Type 1: Polyethylene Terephthalate (PET, PETE).
- b. Type 2: High Density Polyethylene (HDPE).
- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
- d. Type 4: Low Density Polyethylene (LDPE).
- e. Type 5: Polypropylene (PP).
- f. Type 6: Polystyrene (PS).
- g. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

#### 1.6 PERFORMANCE REQUIREMENTS

##### 1.6.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least [\_\_\_\_\_] pounds per square foot (psf).

##### [1.6.2 Tests

Test windows proposed for use in accordance with [AAMA/WDMA/CSA 101/I.S.2/A440](#) for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

[ Test projected windows in accordance with the applicable portions of the [AAMA WSG.1](#) for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

] [Test double-hung windows in accordance with the applicable portions of the [AAMA WSG.1](#) for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

## ]]1.7 DRAWINGS

Submit the [Fabrication Drawings](#) for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

## 1.8 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

## 1.8.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by [AAMA/WDMA/CSA 101/I.S.2/A440](#) for the window types and classification specified in this section.

## [1.8.2 Antiterrorism Performance Requirements

Windows must meet the antiterrorism performance criteria as specified in the paragraphs below in accordance with [UFC 4-010-01](#). Conformance to the performance requirements must be validated by one of the following methods.

## 1.8.2.1 Computational Design Analysis Method

Design window assembly to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window assembly proposed for use, under the given static equivalent loads.

Design window frames, mullions, sashes, and glazing to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window system proposed for use, under the given static equivalent loads.

Glazing resistance must be greater than equivalent 3-second duration loading of [\_\_\_\_\_] [pounds](#) per square foot (psf) for type [\_\_\_\_\_] window and [\_\_\_\_\_] [psf](#) for the remaining window types]. The glazing frame bite for the window frames must be in accordance with [ASTM F2248](#).

Design Aluminum/Steel window framing members to restrict deflections of the edges of glazing they support to L/60 under two times (2X) the glazing resistance per the requirements of [ASTM F2248](#) and [ASTM E1300](#).

[ Anchor window frames to the supporting structure with anchors designed to resist [two times (2X)][one time (1X)] the glazing resistance in accordance with [ASTM F2248](#) and [ASTM E1300](#).

## ]1.8.2.2 Dynamic Design Analysis Method

Design window assembly using a dynamic analysis to prove the system will provide performance equivalent to or better than a [low];[very low]; [\_\_\_\_\_] hazard rating in accordance with [ASTM F2912](#) for the peak positive

pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). Use a triangular blast load using the applicable pressure and impulse indicated above. The allowable response limits of [aluminum] [steel] frame elements are as follows: Maximum ductility ratio of [\_\_\_\_\_] and maximum support rotation of [\_\_\_\_\_] degrees.

#### 1.8.2.3 Standard Airblast Test Method

As an alternative to the 'Computational Design Analysis Method' and 'Dynamic Design Analysis Method' indicated above, window [\_\_\_\_\_] assembly may be tested for evaluation of hazards generated from airblast loading in accordance with [ASTM F1642/F1642M](#) by an independent testing agency regularly engaged in blast testing. For proposed window systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed window size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems in accordance with [ASTM F2912](#). Proposed window system/assembly of a size outside this range will require testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. Perform the test on the entire proposed window system/assembly, including, the glazing, its framing/support system, operating devices, and all anchorage devices. Window support system replicate anchorage of the window support system with the method of installation to be used for the project. The minimum airblast loading parameters for the test will be as follows: peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). The hazard rating for the proposed window systems, as determined by the rating criteria of [ASTM F2912](#), to provide performance equivalent to or better than a [low]; [very low]; [\_\_\_\_\_] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard", "Very Low Hazard" and "Low Hazard" ratings are acceptable. "High Hazard" ratings are unacceptable. Results of window systems previously tested by test protocols other than [ASTM F1642/F1642M](#) may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

#### ]1.8.3 Air Infiltration

Air infiltration must not exceed the amount established by [AAMA/WDMA/CSA 101/I.S.2/A440](#) for each window type.

#### 1.8.4 Water Penetration

Water penetration must not exceed the amount established by [AAMA/WDMA/CSA 101/I.S.2/A440](#) for each window type.

#### 1.8.5 Thermal Performance

Windows (including frames and glass) will be independently tested and certified with a Solar Heat Gain Coefficient (SHGC) determined according to [NFRC 200](#) procedures and a whole window U-factor determined in accordance with [NFRC 100](#) within the ranges as indicated below according to the [ASHRAE 169](#) Climate Zone of the project location. [ Windows used solely within the interior of a conditioned envelope are exempted from meeting U-Factor and SHGC requirements, unless otherwise noted.] Provide visual Transmittance (VT) of 0.5 or greater. Submit documentation supporting compliance with [Energy Star](#), FEMP designated, and Passive House

qualifications as applicable. Provide proof of Energy Star label for residential aluminum window products.

[1.8.5.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [0.40] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

] [1.8.5.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

] [1.8.5.3 North-Central Climate

Windows installed within Climate Zone 4 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.36] [\_\_\_\_\_] or less.

] [1.8.5.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.27] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.36] [0.41] [\_\_\_\_\_] or less.

] [1.8.5.5 Subarctic Climate

Windows installed within Climate Zone 8 will have a U-Factor of [0.08] [0.22] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less. There is no SHGC limit for this climate zone.

] [1.8.6 Life Safety Criteria

Provide windows that conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

] [1.8.7 Sound Attenuation

When tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or the following below, provide a minimum Sound Transmission Class (STC) of 35 in accordance with ASTM E90 and as determined by ASTM E413 or Outside-Indoor Transmission Class (OITC) of 25 in accordance with ASTM E1332 and as determined by ASTM E413 with the window glazed with 1/2 inch air space between two pieces of 1/4 inch.

] [1.8.8 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

- a. Refer to drawings for classification of window requiring basic or enhanced protection.

- [ b. Large-Missile Test: For glazing located within 30 feet of grade.  
 ] [c. Small-Missile Test: For glazing located more than 30 feet above grade.

]]1.9 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. [ Provide aluminum window frames with a minimum recycled content of 20 percent. Provide data identifying percentage of recycled content of aluminum windows.] Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of [\_\_\_\_\_] when tested in accordance with AAMA 1503. Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

2.1.1 Awning Windows (AP)

Type AP-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Conceal operating mechanism within the frame members or enclose within a metal casing not less than 0.0625 inch thick sheet aluminum.

2.1.2 Casement Windows (C)

Type C-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Ventilators must be [ rotary crank] [ handle] operated. Provide ventilators over 65 inches high with two separate locking devices or a two-point locking device operated by rods from a single lever handle. Conceal rods where possible. [ Provide casement windows in combination with [fixed] [projected] windows specified below.]

2.1.3 Hung Windows (H)

[Double] [\_\_\_\_\_] Hung, Type H-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW]- [\_\_\_\_\_] (Optional Performance Grade)]. Test and rate sash balance to conform with AAMA 902.

Design windows, mullions, hardware, and anchors to withstand the wind loading specified.

#### 2.1.4 Horizontal Sliding Windows (HS)

Type HS-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW] - [\_\_\_\_\_] (Optional Performance Grade)].

#### 2.1.5 Projected Windows (AP)

Type AP-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW] - [\_\_\_\_\_] (Optional Performance Grade)]. Provide projected windows with concealed four bar friction hinges only. Gear-type rotary hardware to comply with [AAMA 901](#). Provide operators that function without requiring the removal of interior screens.

#### 2.1.6 Top-Hinged Windows (TH)

Type TH-[CW30] [AW40] [ [CW] [AW] - [\_\_\_\_\_] (Optional Performance Grade)]. Top-hinged windows must be [inswinging] [outswinging].

#### 2.1.7 Vertically Pivoted Windows (VP)

Type VP-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW] - [\_\_\_\_\_] (Optional Performance Grade)]. [ Provide window with remotely operated venetian blind mounted between an access sash and the main sash.]

#### 2.1.8 Fixed Windows (F)

Type F-[R15] [LC25] [CW30] [AW40] [ [R] [LC] [CW] [AW] - [\_\_\_\_\_] (Optional Performance Grade)].

#### 2.1.9 Forced Entry Resistant Windows

In addition to meeting the requirements of [AAMA/WDMA/CSA 101/I.S.2/A440](#), windows designated for resistance to forced entry must conform to the requirements of [AAMA 1302.4](#).

#### 2.1.10 Glass and Glazing

Materials are specified in Section [08 81 00 GLAZING](#).

#### 2.1.11 Caulking and Sealing

Are specified in Section [07 92 00 JOINT SEALANTS](#).

#### 2.1.12 Weatherstripping

[AAMA/WDMA/CSA 101/I.S.2/A440](#). Provide for all ventilating (operable) sash for all windows. Provide woven wool pile weatherstripping [0.210 inch](#) thick, conforming to [AAMA 701/702](#), or polypropylene multifilament fiber weatherstripping installed in an integral weatherstripping groove in the sash or frame, and flexible polyvinylchloride weatherstripping installed in the sill member.

#### 2.1.13 Sash Poles

Seamless aluminum tube, [0.0625 inch](#) minimum wall thickness, [one inch](#) diameter, [\_\_\_\_\_] [feet](#) long, with cast aluminum hook and protective cover or tip on the lower end. Finish must match windows.

## 2.2 FABRICATION

Fabrication of window units must comply with [AAMA/WDMA/CSA 101/I.S.2/A440](#).

### 2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown [or specified]. [ For minimum antiterrorism windows, attach glazing to its supporting frame using structural silicone sealant or adhesive glazing tape in accordance with [ASTM F2248](#).] Design sash for [ inside] [ outside] [ single] [ double] glazing and for securing glass with [ metal beads,] [ glazing clips,] [ glazing channels,] or glazing compound.

### 2.2.2 Fasteners

Use window manufacturer's standard for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than  $1/16$  inch thick.

### 2.2.3 Adhesives

Provide joint sealants as specified in Section [07 92 00 JOINT SEALANTS](#). For interior application of joint sealants, comply with applicable regulations regarding reduced VOC's, and as specified in Section [07 92 00 JOINT SEALANTS](#).

### 2.2.4 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

### 2.2.5 Combination Windows

Windows used in combination must be factory assembled of the same class and grade. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

### 2.2.6 Mullions and Transom Bars

[Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with [ASTM F2248](#) and [ASTM E1300](#).] Provide mullions with a thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. [ Where window cleaner anchors are required, reinforce mullions and anchor to adjoining construction so as to provide safe and adequate support.] Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance. [ Provide special covers over structural support at mullions as indicated.]

### 2.2.7 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation. [ Furnish extruded aluminum subframe receptors [ and subsill] with each window unit.]

#### 2.2.7.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide [stainless steel ]hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

#### 2.2.7.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

#### 2.2.7.3 Window-Cleaner Anchors

Provide double head anchors for windows[ indicated][ specified]. Anchors must be stainless steel of size and design required for the window type and application, conforming to ASTM A276/A276M. Provide two anchors for each single window[ and each adjacent fixed glass window unit]. Fasten anchors 44 inches above the window sill utilizing appropriate methods for the window type and application in accordance with industry safety standards.

#### 2.2.7.4 Window Anchors

Anchoring devices for installing windows must be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA/WDMA/CSA 101/I.S.2/A440.

#### 2.2.8 Finishes

Comply with NAAMM's "Metal Finishes Manual" for applying and designating finishes. Exposed aluminum surfaces must be factory finished with an[ anodic coating][ or][ organic coating]. [ Color must be [\_\_\_\_\_] [ as indicated].] All windows[ for each building] must have the same finish.

##### 2.2.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

- [ a. Architectural Class II ( 0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color] anodized.
- ] [b. Architectural Class I ( 0.7 mil or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.

##### ]2.2.8.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a[ baked enamel finish in accordance with AAMA 2603 with total dry film thickness not less than 0.8 mil][ high-performance finish in accordance with [AAMA 2604][AAMA 2605] with total dry film thickness of not less than 1.2 mils].



### 2.2.9 Screens

AAMA/WDMA/CSA 101/I.S.2/A440. Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware. Manufacturers standard aluminum frame complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusion, concealed fasteners and removable PVC spline/anchors concealing edge of frame.

#### 2.2.9.1 Insect Screen

Insect screen mesh to be [ Glass-fiber mesh, 18x16 of PVC-coated glass-fiber threads; woven and fused to form a fabric mesh in accordance with ASTM D3656/D3656M] [ Aluminum wire fabric, 18x16 mesh of 0.011 inch diameter coated aluminum wire].

### 2.3 SPECIAL OPERATORS

For windows having operating hardware or locking or latching devices located more than 6 feet above the floor, provide suitably designed operators or locking or latching devices necessary for convenient and proper window operation.

#### 2.3.1 Pole Operators

Poles must be of proper length to permit window operation from 5 feet above the floor. Provide one pole operator for each room, and one pole hanger for each pole. Locate hangers where directed.

#### 2.3.2 Extension Crank Operators

Provide removable handles for crank-operated rotary-type operators located more than 6 feet above the floor. Provide one removable handle for each room.

#### 2.3.3 Mechanical Operators

Provide [manual] [electric motor driven] operators for group operation of continuous rows of windows [located [\_\_\_\_\_] feet above the floor]. Operators must be capable of opening and closing windows without appreciable deflection, vibration or rattle. Provide means of adjustment for transmission lines. Provide operators to control window units in groups [as recommended by the window manufacturer] [or] [as indicated].

### 2.4 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

- a. Aluminum alloy must be 6063-T6.
- b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner

frame. Metal fasteners, straps, or anchors must not bridge the connection between the inner and outer frame.

- c. Operating hardware for each sash must consist of spring-loaded nylon cushion blocks and pin locks designed to lock in predetermined locations.
- d. Sash must be completely separated from metal-to-metal contact by means of woven-pile weatherstripping, plastic, or elastomeric separation members.
- e. Operating and storm sash must be factory-glazed with the type of glass indicated and of the quality specified in Section 08 81 00 GLAZING.

## 2.5 MULLIONS

Provide mullions between multiple-window units where indicated.

Provide profiles for mullions and mullion covers, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members must be fabricated of the materials specified in AAMA/WDMA/CSA 101/I.S.2/A440 and meet the specified design loading.

## 2.6 WINDOW CLEANERS' BOLTS

Provide window cleaners' bolts for all windows 7 feet or higher above finished grade, except for windows that can be removed and cleaned from the ground or from a lower roof level without the use of an extension ladder. Provide two bolts for each single window unit and each fixed glass unit. Locate bolts 44 inches above the window sill.

Window cleaners' bolts must be double-head type, AISI Series 300 corrosion-resistant steel, size and design complying with IWCA I-14.1. Contact side of the bolts must be ground to fit flat against window jambs. Bolts must be factory- or field-attached before windows are set. Reinforce backs of frames to receive bolts with 1/4 by 6-inch corrosion-resistant steel or aluminum plates bolted or welded to the frames at the factory. Special wall anchors must be provided on frames at the point of bolt attachment.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation,

location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

### 3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to [AAMA/WDMA/CSA 101/I.S.2/A440](#). Do not coat surfaces in contact with sealants after installation with any type of protective material. Do not apply coatings or lacquers to surfaces to which caulking and glazing components must adhere.

### 3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than  $7/16$  inch.

### 3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. [ Adjust double hung windows to operate with maximum applied force of 25 pounds in either direction, not including breakaway friction force.] Verify that products are properly installed, connected, and adjusted.

## 3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

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## SECTION 08 51 23

## STEEL WINDOWS

08/20, CHG 1: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA/WDMA/CSA 101/I.S.2/A440 (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM D3656/D3656M (2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E330/E330M (2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass
ASTM F2912	(2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings

## NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2020) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code

## STEEL WINDOW INSTITUTE (SWI)

SWI SWS	(2017; R 2018) Steel Window Specifications
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## U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01	(2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Windows

## SD-03 Product Data

Steel Framing Materials

Recycled Content for Steel Framing Materials; S

Mullions

Hardware

Hardware Materials

Fasteners

Accessories

Operators

Screens

## SD-04 Samples

Color Coating; G[, [\_\_\_\_\_]]

Windows

## SD-05 Design Data

Structural Calculations for Deflection; G[, [\_\_\_\_\_]]

Design Analysis; G[, [\_\_\_\_\_]]

## SD-06 Test Reports

Air Infiltration

Water Infiltration

Mullion and Transom Bar Wind Load

Minimum Condensation Resistance Factor

[ Resistance to Forced Entry

][ Standard Airblast Test; G[, [\_\_\_\_\_]]

] [ Windborne-Debris-Impact Performance  
] SD-07 Certificates  
[ Engineer's Qualifications  
] SD-10 Operation and Maintenance Data  
Windows, Data Package 1; G[, [\_\_\_\_]]

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Shop Drawing Information

Indicate elevations of windows, full-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attachment of screens,] [metal subframes,] [stools,] [casings,] [sills,] [trim,] other related items, and installation details.

#### 1.3.2 Color Coating Samples Information

Submit chart of manufacturer's color coatings if factory finish is to be provided in lieu of field painting.

#### 1.3.3 Windows Samples Information

Submit one complete, full size glazed window of each type proposed for use, complete with hardware, anchors, and other accessories. [ Where screens or weatherstripping are required, fit sample windows with such items that are to be used.] After approval, install each sample in the work, clearly identified, with location recorded.

#### [1.3.4 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

#### ] [1.3.5 Design Data Requirements

Submit **structural calculations for deflection** to substantiate compliance requirements [ and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations. Submit **design analysis** with calculations showing that the design of each different size and type of steel window unit and its anchorage to the structure [.] [ meets the requirements of paragraph ANTITERRORISM PERFORMANCE REQUIREMENTS.] Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

### ] 1.4 TEST REPORT REQUIREMENTS

#### 1.4.1 Air and Water Infiltration



ASTM E283 and ASTM E331. Do not exceed maximum air infiltration of one-half cubic foot per minute per foot of crack length when subjected to a static pressure of 1.56 pounds per square foot (equivalent to a wind velocity of 25 miles per hour (mph)). Water infiltration must be "zero."

#### 1.4.2 Mullion and Transom Bar Wind Load Tests

ASTM E330/E330M. Members must withstand a uniform wind load of 20 pounds per square foot of window area without deflecting more than 1/175 of the span.

#### 1.4.3 Blast Testing

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, [and] minimum condensation resistance factor (CRF) [, and] resistance to forced entry] [, and, for Antiterrorism windows, in lieu of a Design Analysis, results of a Standard Airblast Test]. [ For Antiterrorism windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shock tube, must be included in a test report, providing information in accordance with ASTM F1642/F1642M, as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph STANDARD AIRBLAST TEST METHOD.]

### 1.5 WINDOW PERFORMANCE

Steel windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

#### 1.5.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

#### 1.5.2 Thermal Performance

Non-residential glazed systems (including frames and glass) must be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] determined according to NFRC 200 procedures and a U-factor maximum of [\_\_\_\_\_] Btu per square foot by hr by degree F in accordance with NFRC 100.

#### [1.5.3 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner

as glazing indicated for use on Project.

a. Refer to drawings for classification of window requiring basic or enhanced protection.

[ b. Large-Missile Test: For glazing located within 30 feet of grade.

]c. Small-Missile Test: For glazing located more than 30 feet above grade.

][1.5.4 Antiterrorism Performance Requirements

Windows must meet the antiterrorism performance criteria as specified in the paragraphs below in accordance with [UFC 4-010-01](#). Conformance to the performance requirements must be validated by one of the following methods.

1.5.4.1 Computational Design Analysis Method

Design window assembly to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window assembly proposed for use, under the given static equivalent loads.

Design window frames, mullions, sashes, and glazing to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window system proposed for use, under the given static equivalent loads.

Glazing resistance must be greater than equivalent 3-second duration loading of [\_\_\_\_\_] Pascal pounds per square foot (psf) for type [\_\_\_\_\_] window[ and [\_\_\_\_\_] Pascal psf for the remaining window types]. The glazing frame bite for the window frames must be in accordance with [ASTM F2248](#).

Design Steel window framing members to restrict deflections of the edges of glazing they support to L/60 under two times (2X) the glazing resistance per the requirements of [ASTM F2248](#) and [ASTM E1300](#).

[ Anchor window frames to the supporting structure with anchors designed to resist [two times (2X)][one time (1X)] the glazing resistance in accordance with [ASTM F2248](#) and [ASTM E1300](#).

]1.5.4.2 Dynamic Design Analysis Method

Design window assembly using a dynamic analysis to prove the system will provide performance equivalent to or better than a [low;] [very low;] [\_\_\_\_\_] hazard rating in accordance with [ASTM F2912](#) for the peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). Use a triangular blast load using the applicable pressure and impulse indicated above. The allowable response limits of [aluminum] [steel] frame elements are as follows: Maximum ductility ratio of [\_\_\_\_\_] and maximum support rotation of [\_\_\_\_\_] degrees.

1.5.4.3 Standard Airblast Test Method

As an alternative to the 'Computational Design Analysis Method' and 'Dynamic Design Analysis Method' indicated above, window [\_\_\_\_\_] assembly may be tested for evaluation of hazards generated from airblast loading in accordance with [ASTM F1642/F1642M](#) by an independent testing agency

regularly engaged in blast testing. For proposed window systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed window size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems in accordance with [ASTM F2912](#). Proposed window system/assembly of a size outside this range will require testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. Perform the test on the entire proposed window system/assembly, including, the glazing, its framing/support system, operating devices, and all anchorage devices. Window support system replicate anchorage of the window support system with the method of installation to be used for the project. The minimum airblast loading parameters for the test will be as follows: peak positive pressure of [ ] pounds per square inch (psi) and peak positive phase impulse of [ ] pounds per square inch - millisecond (psi-msec). The hazard rating for the proposed window systems, as determined by the rating criteria of [ASTM F2912](#), to provide performance equivalent to or better than a [low;] [very low;] [ ] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard", "Very Low Hazard" and "Low Hazard" ratings are acceptable. "High Hazard" ratings are unacceptable. Results of window systems previously tested by test protocols other than [ASTM F1642/F1642M](#) may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

#### ]1.6 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

#### 1.7 DELIVERY AND STORAGE

Deliver to project site in undamaged condition. Store windows and components on edge, out of contact with the ground, under weathertight covering, and arranged to avoid bending, warping, or other damage.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 General System Requirements

[Steel framing materials](#) must contain a minimum of 40 percent total recycled content. Provide data identifying percentage of [recycled content for steel framing materials](#).

##### 2.1.2 Steel Bars

[SWI SWS](#).

##### 2.1.3 Sheet Steel

[ASTM A1011/A1011M](#).

##### 2.1.4 Zinc-Coated Sheet Steel

[ASTM A653/A653M](#).

##### 2.1.5 Zinc Coating

ASTM A123/A123M.

#### 2.1.6 Screws and Bolts

ASME B18.6.3 as applicable.

#### 2.2 FABRICATION OF WINDOWS

Form permanent joints by welding or mechanically fastening as specified for each type window. Use joints of strength to maintain structural value of members connected. Weld joints solid, remove excess metal, and dress smooth on exposed and contact surfaces. Closely fit joints formed with mechanical fastenings and make permanently watertight. Assemble frames and sash, including ventilators and thermal breaks, at the plant and ship as a unit with hardware unattached. Provide the following construction:

- a. Where fixed window sections adjoin ventilator sections, provide fixed sash, fabricated from similar frame members, and of manufacturer's standard type suitable for the purpose.
- b. Roll weathering surfaces integrally to provide two-point parallel-surface contact with overlap at both inside and outside points of closure.
- c. Provide drips and weep holes as required to return water to outside.
- d. Design glazed windows and rabbets suitable for glass thickness shown on drawings [or specified].
- e. Use flathead, cross recessed type, exposed head screws and bolts with standard threads on windows, trim and accessories. Screw heads must finish flush with adjoining surfaces. Self tapping sheet-metal screws are not acceptable.
- f. For hot-dipped galvanized windows, use stainless steel or hot-spun galvanized steel fasteners. For windows with painted finish use electro-galvanized fasteners. Finish exposed heads to match finish of windows.

#### 2.3 FIRE RATED WINDOWS

Provide sash and frame with necessary hardware to conform to the requirements of Underwriters Laboratories Inc. (UL), for class of window indicated. Submit proof of conformance. UL label will be accepted as proof. Labeled window details take precedence over details indicated or specified for nonlabeled windows, except when sections required for nonlabeled windows are heavier than those required by UL. In lieu of UL label, written certification by approved nationally recognized testing agency may be submitted. Certification must state that complete window unit of type provided has been tested and conforms to published standards, including methods of tests, of UL.

#### 2.4 PROVISIONS FOR GLAZING

Design sash for [inside] [outside] glazing and for securing glass with [metal beads] [glazing clips] and glazing compound. [ Where insulating glass is indicated, use rabbets of adequate weight and depth to receive and properly support glass and glazing accessories. ] [ For windows required to

comply with antiterrorism provisions, design in accordance with Standard 10 of [UFC 4-010-01](#).]

## 2.5 [MULLIONS AND TRANSOM BARS](#)

Provide mullions between multiple window units designed to withstand specified wind load requirements. [ Provide mullions with a thermal break.] Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form weathertight joint. Provide mullion covers of manufacturer's stock design on the interior and exterior to completely cover exposed joints and recesses between window units and for neat appearance. [ Provide special covers over structural supports at mullions as indicated.]

## 2.6 [METAL-TO-METAL JOINTS](#)

Set in mastic, using type recommended by window manufacturer to provide weathertight joints. Remove excess mastic before it hardens.

## 2.7 [ACCESSORIES](#)

Provide windows with hardware, clips, fins, anchors, glazing beads, and fastenings, necessary for complete installation and operation of ventilators.

### 2.7.1 [Anchors](#)

Use hot-dip galvanized steel anchors. Secure anchors and fastenings to heads, jambs, and sills of openings, and fasten securely to windows or frames. Use anchors recommended by window manufacturer for specific type of construction and conceal. Anchor each frame at jambs with minimum of three adjustable steel anchors. [ Provide perforated anchor stems for mortar keying with anchor flanges of sufficient width to provide sliding friction fit inside frames. Extend perforated stems not less than [4 inches](#) into masonry.] [ For anchorage at concrete walls and prepared openings, equip frames with manufacturer's standard bent-clips located approximately [6 inches](#) from each end and at midpoint.]

### 2.7.2 [Weatherstripping](#)

Provide on all operable windows so that, when tested before leaving factory, in accordance with [ASTM E283](#), do not exceed a maximum air infiltration of [one half cubic foot per minute per foot](#) of crack length when subjected to static pressure of [1.56 pounds per square foot](#) equivalent to wind velocity of [25 mph](#).

### 2.7.3 [Hardware](#)

Equip all operable sash with latching device which can be secured from inside. The item, type, and function of hardware required are specified under individual window type. Attach hardware securely to windows with corrosion resisting bolts or machine screws; do not use sheet metal screws. At fixed screens, adapt hardware to permit operation of ventilators. Fit and test hardware for each window at factory to ensure satisfactory operation and security.

#### 2.7.3.1 [Hardware Materials](#) and Finish

Provide [ non-magnetic type stainless steel exposed hardware with satin

finish][ white bronze with satin finish hardware][ yellow bronze with dull (oxidized) finish hardware]. Use galvanized steel or malleable iron hinges, with nonferrous pins, or with steel pins and non-ferrous bushings or washers.

#### 2.7.4 Fasteners

Stainless steel or aluminum materials[; zinc-coated steel elsewhere as shown on Drawing Sheet No. [\_\_\_\_\_.]] Prime exposed heads of coated or plated fasteners and finish to match adjacent material.

#### 2.7.5 Metal Sub-frames and Stools

Manufacturer's standard type designed to suit the particular window. Match exposed surfaces to windows.

### 2.8 GLASS AND GLAZING

Provide materials in accordance with Section 08 81 00 GLAZING.

### 2.9 WINDOW FINISH

#### 2.9.1 Shop Primed Finish

After fabrication, clean all surfaces of windows, fins, mullions, cover plates, and screen frames and provide a hot-dip galvanized, phosphate-treated and shop primed finish. Conform to SWI SWS for the methods of cleaning, chemical treatment, galvanizing, and painting.

#### 2.9.2 Factory Finish

In lieu of shop primed finish, factory finish may be provided using the following method, in which case finish field painting will not be required:

- a. Chemically clean and bonderize windows. Apply dip coat of epoxy primer baked on for not less than 15 minutes at not less than 300 degrees F, followed by finish coat of alkyd-amine enamel of not less than one mil thickness, baked on for 15 minutes at not less than 300 degrees F.
- b. Finish color coating to be selected from manufacturer's standard color chart.
- c. Touch up abraded surfaces with enamel as specified for factory finish.

### 2.10 WINDOW TYPES

Conform to SWI SWS. Provide combinations, types and sizes indicated. Each window must consist of a unit including [subframe,] [frame,] sash, hardware, [mullions,] trim, [casing,] [insect screen,] [storm units,] and anchors. Design windows indicated to have screen [or storm units] to accommodate items to be furnished.

#### 2.10.1 Awning Windows

Provide compression-type weatherstripping. Heavy Intermediate materials in group of top-hinged or projected out-swinging ventilators:

##### 2.10.1.1 Operators

[ Control must be simultaneous by means of cam-type lever handle fastener for hand push-pull operation. For windows with screens, provide with underscreen push bar operators. For operators more than 6 feet above floor, provide with hardware designed for pole operation.

] [Provide simultaneous control by means of a rotary mechanical power unit manually operated by bronze [removable] crankhandle, providing positive adjustment and holding of vents in any position from fully open to fully closed. Operator must securely close ventilators on both sides of window without additional locking devices. Heavy-duty worm-gear rotary operator with machine-cut case-hardened steel gears in steel housing with smooth lacquer finish.

#### ] 2.10.1.2 Ventilators

Support on two hinges and two arms, or on two steel slide arms pivoted to vent and to principal frame member. Provide bronze-brushed pivots and hinges with bronze pins. Design ventilators to close and weather on each other, or on independent meeting rails assembled as part of window frame. Provide for positive adjustment of individual vents to ensure positive contact between sash and frame when closed.

#### 2.10.2 Casement Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom]. Provide continuous drip molds immediately above ventilators. Where fixed sections adjoin ventilators, provide drips continuous across top of fixed sections. Provide each side hinged ventilator with one pair of non-friction extension hinges, one sash operator, and one locking handle. Provide sash over 66 inches high with three hinges. Provide hinges with strength necessary to permanently support glazed ventilator without twist or sag. Provide compression-type weatherstripping.

##### 2.10.2.1 Sash Operators

Use [sliding underscreen] [crank-operated rotary] sash operators. Design operators to hold ventilators firmly in position at any angle up to 90 degrees. [ Use friction or thumb-screw sliding operators.] Use heavy-duty worm-gear rotary operators, with machine-cut, case hardened steel gears. Provide pivoted lever type locking handles, engaging beveled strike plate or keeper. For ventilators exceeding 66 inches in height, provide two-point locking device, operated by rods from single lever handle. Conceal rods where design of sash section will permit.

##### 2.10.2.2 Hopper or Sill Type Ventilators

For hopper or sill type ventilators occurring under casement or fixed sash, provide cam-acting locking handle. For hinged type, provide one pair of hinges and two concealed friction stay arms; for projected type, use two friction shoes with nonfriction stay arms to hold ventilator in any position, up to 45 degrees. For hopper vents over 48 inches wide, use two locking handles.

##### 2.10.2.3 Transom Ventilators

When transom ventilators occur above casement or fixed sash, hang on two stay arms sliding in friction shoes. Provide ventilators with hardware designed for pole operation.

### 2.10.3 Continuous Windows

Continuous type with [manual] [motorized] mechanical operation.

### 2.10.4 Fixed Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom] windows.

### 2.10.5 Horizontally Pivoted Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom]. Make pivots integral with jamb weathering bars to ensure permanent alignment. Hold ventilator in place at pivots with solid bronze, replaceable shouldered pivots, washer and nuts.

#### 2.10.5.1 Operators

Equip ventilators with chain roller guide, chain and chain stay located at convenient distance from floor. Attach chain to spring-latch at ventilator head, looping down and back up through roller-guide in spring-catch. Secure end to keeper on frame. Unscreened ventilators readily accessible from floor may have steel stay adjusters.

### 2.10.6 Projected Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom].

#### 2.10.6.1 Operators

Equip ventilators under 48 inches wide with one cam-type lever handle fastener; equip ventilators 48 inches wide and over, and not pole operated, with two fasteners. Where fixed screens occur at projected-out ventilators, provide underscreen push bar operators. Provide ventilators with locking rails more than 6 feet above the floor with hardware designed for pole operation.

### 2.10.7 Security Windows

**SWI SWS.** Provide ventilators with manufacturer's standard hardware of iron, steel or zinc. Equip ventilators having locking rails more than 6 feet above floor with hardware designed for pole operation.

## 2.11 SCREENS

Provide one insect screen for each operable exterior sash or ventilator. Locate screen units either inside or outside, depending upon window type and method of operation. Provide [full-length top-hung] [double vertical sliding] [half-length sliding] [half-length fixed] type screens. Design screens to fit closely around entire perimeter of ventilator or opening, to be rewirable, easily removable from inside building, and interchangeable for same size ventilators of similar type windows, with minimum of exposed fasteners and latches. Provide all guides, stops, clips, bolts, and screws, as necessary, for a secure and insect-tight attachment to window. Where wickets are necessary, use sliding or hinged type, with friction catches, framed and trimmed for durability and tight fit. Provide wicket opening frames of similar material and cross-section as screen frames. Provide continuous framing bar between the two sides of screen frames.

### 2.11.1 Construction



Provide screen frames of steel with finish matching that of windows. Equip frames with removable splines of steel or vinyl. Form groove in frame for holding screen cloth in place with noncylindrical splines. Make spline and groove assembly so that cloth cannot be removed from groove by pressure on cloth. Make splines of such size and shape that rotation of spline in groove will be prevented and spline will tightly hold cloth in place.

#### 2.11.2 Insect Screening

ASTM D3656/D3656M, Class 2, 18 by 14 mesh, color [charcoal] [gray] [\_\_\_\_\_]. Install with weave parallel to frames. Stretch tight for smooth appearance. Conceal edges in spline channels.

#### 2.12 SPECIAL OPERATORS

##### 2.12.1 Pole Operators

Provide for windows having operating hardware or locking rails more than 6 feet above floor. Provide window manufacturer's standard pole design of length to provide operation from 5 feet above floor, and with push-pull hooks of proper shape and length. Provide one pole operator for each room, and one pole hanger for each pole in location as directed.

##### [2.12.2 Extension Crank Operators

Provide removable handles for crank operated rotary operators located more than 6 feet above floor. Provide one removable handle for each room.

##### ]2.12.3 Mechanical Operators

Provide [manual] [motorized] operators for group operation of continuous rows of windows, and for windows located at unusual heights, where other types of remote operation are not feasible. Provide operators that open and close windows without appreciable deflection, vibration or rattle. Provide transmission lines equipped with means of adjustment. Control window units in groups with operators as recommended by window manufacturer for the particular window arrangement shown, unless specifically indicated otherwise. Use mechanical operators of one of the following types:

- a. On-Sill Operators: Centrally located, manually controlled mechanisms for adjusting ventilators, assembled of bronze telescoping shafts with machine cut threads. Conceal, except for linkage members, by appropriate covers. Provide one operator, secured to sill, for each window. Finish operators exposed to view to match hardware finish. Finish covers to match window casings.
- b. Geared Lever-Arm Operator: Provide power unit with machine-cut gears and machined thrust bearings housed in dustproof oil-tight case, with provision for lubrication. Provide torsion shaft of standard black iron pipe not less than one inch inside diameter. Rigidly clamp steel or malleable iron operating arms to shaft and connect to ventilator by push bar and hinge bracket. Support operating mechanism on brackets securely attached to building structure or mullions. No single line is allowed to extend more than 30 feet from either or both sides of power unit.
- c. Geared Rack-and-Pinion Operator: Provide power unit with machine-cut gears and machined thrust bearings housed in dustproof oil-tight case,

with provision for lubrication. Provide torsion shaft of standard black iron pipe not less than **one inch** inside diameter. Cut steel rack to a pitch that will mesh accurately with the cut teeth on a steel or cast iron pinion. Fasten pinion securely to torsion shaft. Provide steel rack with a hinged bracket for attaching to ventilator. Hold rack in mesh with pinion by steel yoke with bearing rollers of solid brass. Support operating mechanism on steel brackets securely attached to building structure or mullions. No single line is allowed to extend more than **50 feet** from either or both sides of power unit.

#### [2.12.3.1 Operating Arms and Racks

Provide each ventilator not more than **36 inches** wide with single operating arm or rack attached at center of rail. Provide each ventilator more than **36 inches** wide with two operating arms or racks attached to side rails or near ends of horizontal rail of ventilator.

#### ] [2.12.3.2 Chain Control

Provide power unit with hand chain, operating over chain wheel with chain guard. Drill and secure wheel to worm shaft by key. Terminate chain approximately **2 feet** above floor. Where building construction makes it impracticable to hang chain vertically from power unit, furnish single or double chain idlers to convey chain to point shown or directed.

#### ] [2.12.3.3 Steel Shaft Control

Provide power unit with vertical standard black iron pipe of not less than **0.75 inch** inside diameter or solid steel shaft with malleable iron or steel coupling. Support vertical shaft with brackets spaced not over **6 feet** apart. Where hand operating wheel is indicated **4 feet 6 inches** above floor, place wheel in vertical position. Where hand operating wheel is indicated **6 feet 6 inches** above floor, place wheel in horizontal position. Secure wheel in place permanently. Furnish universal joints or beveled gears to locate control at point shown or as directed on nearest wall or column. Where practicable, mount vertical shafts on walls instead of pilasters.

### ] PART 3 EXECUTION

#### 3.1 INSTALLATION

Install in accordance with window manufacturer's printed instructions and details. Coordinate installation with commissioning as specified in Section [\_\_\_\_]. [ Install fire rated windows in accordance with **NFPA 80** and **NFPA 101**.] Build in windows as work progresses or install without forcing into prepared window openings. Set at proper elevation, location, and reveal; plumb, square, level, and in alignment. Brace and stay to prevent distortion and misalignment. Protect ventilators and operating parts against dirt and building materials by keeping closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant recommended by window manufacturer. Install and seal windows in a manner that will prevent entrance of water and wind. [ Fasten insect screens securely in place.]

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

### 3.2 ANCHORS AND FASTENINGS

Make provision for securing units to each other and to adjoining construction. Design head and jamb members to enter into masonry not less than  $7/16$  inch where windows are installed in direct contact with masonry. Where windows are set in prepared masonry openings, build in anchors and fastenings to jambs of openings and fasten securely to windows or frames and to adjoining construction. Space anchors not more than 18 inches apart on jambs and sills, and install a minimum of three anchors on each side of each opening. Anchors and fastenings must have sufficient strength to hold member firmly in position. Where type, size, or spacing of anchors is not shown or specified, use expansion or toggle bolts or screws as best suited to construction material. Provide expansion shield and bolt assemblies of type designed to give holding power beyond tensile and shearing strength of bolt. Minimum fastener penetration must be not less than that recommended by manufacturer for type fastener and wall material involved.

### 3.3 OPERATORS

Install operators before glazing. Plumb and level shaft risers and runs. Adjust ventilators for free opening and tight closing. Secure housings and adjustable supports to wall. Anchor operator parts to steel window mullions with  $1/2$  inch bolts. Couple individual lengths of shafting with steel rivets or bolts. Leave mechanical equipment and ventilators in proper operating condition.

### 3.4 WEATHERSTRIPPING

Use bronze, spring-brass, or stainless steel and secure with non-ferrous screws. Secure weatherstripping or rubbing-blocks to parting-strip and each end of meeting-rails. For solid bar stock windows, use manufacturer's standard weatherstripping inserted into groove.

### 3.5 ADJUSTMENTS AFTER INSTALLATION

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts. Adjust weatherstripping to assure weathertight contact with frames when ventilators are closed and locked. Weatherstripping must not cause binding of sash, or prevent closing and locking of ventilator. Verify products are properly installed, connected, and adjusted.

### 3.6 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance and to prevent fouling of weathering surfaces and weatherstripping, or interference with operation of hardware. Clean and touch up abraded surfaces. Replace with new windows any stained, discolored, or abraded windows that cannot be restored to original condition.

-- End of Section --

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## SECTION 08 52 00

## WOOD WINDOWS

08/20, CHG 1: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

AAMA/WDMA/CSA 101/I.S.2/A440 (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 169 (2013) Climate Data for Building Design Standards

## ASTM INTERNATIONAL (ASTM)

ASTM D1784 (2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D3656/D3656M (2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

ASTM D6330 (1998; R 2014) Standard Practice for Determination of Volatile Organic Compounds (Excluding Formaldehyde) Emissions from Wood-Based Panels Using

Small Environmental Chambers Under Defined Test Conditions

ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E413	(2022) Classification for Rating Sound Insulation
ASTM E1332	(2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2020) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA 1004	(1987; R 1998) Aluminum Tubular Frame Screens for Windows
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U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01	(2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings
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U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
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WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S.4	(2015A) Preservative Treatment for Millwork
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for

Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wood Windows; G[, [\_\_\_\_\_]]

SD-03 Product Data

Wood Windows; G[, [\_\_\_\_\_]]

[ Energy Star Label for Residential Windows; S

] Engineered Wood Products

Fasteners

Adhesives; G[, [\_\_\_\_\_]]

SD-08 Manufacturer's Instructions

Wood Windows

SD-10 Operation and Maintenance Data

Wood Windows, Data Package 1; G[, [\_\_\_\_\_]]

Plastic Identification

1.2.1 Shop Drawing Information

Indicate elevations of units, full-size sections, fastenings, methods of installation and anchorage, method of glazing, locations of operating hardware, mullion details, method and material for weatherstripping, [bar and muntin layouts, ]method of attaching[ insect screens], details of installation, and connections with other work.

1.2.2 Wood Windows Manufacturer's Instructions

Submit manufacturer's written instructions for installation.

1.2.3 Engineered Wood Products

Submit documentation verifying that no urea-formaldehyde resins were used.

1.2.4 Plastic Identification O & M Data

When not labeled, identify types in Operation and Maintenance Manual per paragraph MATERIAL IDENTIFICATION REQUIREMENTS.

1.3 DELIVERY AND STORAGE

Deliver windows to site in sealed undamaged cartons or in palletized multiple units. Protect from damage, dampness and extreme temperature or humidity changes. Store under cover in well-ventilated enclosed space. Do not store in a building under construction until concrete, masonry, and plaster are dry. Replace defective or damaged windows.

## 1.4 MATERIAL IDENTIFICATION REQUIREMENTS

### 1.4.1 Plastic Identification

Label plastic products provided to indicate their polymeric composition according to the following list. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.

Type 1: Polyethylene Terephthalate (PET, PETE).

Type 2: High Density Polyethylene (HDPE).

Type 3: Vinyl (Polyvinyl Chloride or PVC).

Type 4: Low Density Polyethylene (LDPE).

Type 5: Polypropylene (PP).

Type 6: Polystyrene (PS).

Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

## 1.5 WINDOW PERFORMANCE

Provide wood windows meeting the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

### 1.5.1 Thermal Performance

Windows (including frames and glass) will be independently tested and certified with a Solar Heat Gain Coefficient (SHGC) determined according to NFRC 200 procedures and a whole window U-factor determined in accordance with NFRC 100 within the ranges as indicated below according to the ASHRAE 169 Climate Zone of the project location. [ Windows used solely within the interior of a conditioned envelope are exempted from meeting U-Factor and SHGC requirements, unless otherwise noted.] Provide visual Transmittance (VT) of 0.5 or greater. [ Residential glazed systems (including frames and glass) must be Energy Star label for residential windows labeled products for the [Northern] [North-Central] [South-Central] [Southern] climate zone. Provide proof of Energy Star label for residential windows.]

#### [1.5.1.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [0.40] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

#### ] [1.5.1.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

#### ] [1.5.1.3 North-Central Climate



Windows installed within Climate Zone 4 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.40] [\_\_\_\_\_] or less.

] [1.5.1.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.27] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less. There is no SHGC limit for this climate zone.

] [1.5.1.5 Non-residential Windows

Non-residential glazed systems (including frames and glass) must be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] determined according to NFRC 200 procedures and a U-factor maximum of [\_\_\_\_\_] Btu per square foot by ht by degree F in accordance with NFRC 100.

] [1.5.2 Sound Attenuation

When tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or the following below, provide a minimum Sound Transmission Class (STC) of 35 in accordance with ASTM E90 and as determined by ASTM E413 or Outside-Indoor Transmission Class (OITC) of 25 in accordance with ASTM E1332 and as determined by ASTM E413 with the window glazed with 1/2 inch air space between two pieces of 1/4 inch.

] [1.5.3 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

a. Refer to drawings for classification of window requiring basic or enhanced protection.

[ b. Large-Missile Test: For glazing located within 30 feet of grade.

] [c. Small-Missile Test: For glazing located more than 30 feet above grade.

] ] PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible.

2.1.2 Engineered Wood Products

Products cannot contain added urea-formaldehyde. Determine Volatile Organic Compounds (VOCs), excluding formaldehyde, emitted from manufactured wood-based panels in accordance with ASTM D6330. Products must not be used if VOC emissions exceed [\_\_\_\_\_] .

## 2.2 WOOD WINDOWS

Wood windows must consist of complete units including sash, glass, frame, weatherstripping, [insect screen,] and hardware. Window units must meet the Grade 40 requirements of AAMA/WDMA/CSA 101/I.S.2/A440, except maximum air infiltration must not exceed 0.34 CFM per linear foot of sash crack when tested under uniform static air pressure difference of 1.57 psf. In addition to general hardware requirements of AAMA/WDMA/CSA 101/I.S.2/A440, provide hardware for various window types as indicated below. Glass and glazing materials must conform to Section 08 81 00 GLAZING. For good sash insulation performance, preference must be given to engineered wood core clad in wood veneer or PVC-wood composite (uninsulated), using post-industrial wood fiber and 100 percent post-consumer HDPE plastic.

[Wood members which will receive transparent finish must be in one piece, not finger-jointed.][ For windows required to comply with antiterrorism provisions, design in accordance with Standard 10 of UFC 4-010-01.]

### 2.2.1 Single-Hung and Double-Hung Windows

Provide with one sash fastener and two sash lifts, except provide one sash lift when window is fitted with a balance that counterbalances weight of sash.

### 2.2.2 Awning Windows (Top Hinged)

Awning window ventilators in same bay must operate [separately] [in unison]. Provide two or more hinges, pivots, or sash-supporting arms for each operative sash to allow easy operation, substantial support and cleaning of both sides of sash from inside. Provide latches for securing each sash if operating devices do not include locking features. Provide operating devices for controlling position of sash, including full open, tight close, and intermediate firm hold. Provide operating devices with rotary operators of worm-gear type with wear-resistant and impact-resistant gears or lever operators of lever handle, off-set arm type. Provide venting sash with corrosion resistant steel hinges connected to top and bottom rails of sash. When lever operators are used, operating arms must be adjustable so that even sash edge contact can be maintained. Provide compression-type weatherstripping.

### 2.2.3 Casement Windows

Provide two or more hinges, pivots, or sash-supporting arms for each operative sash to allow easy operation, substantial support and cleaning of both sides of sash from inside. Provide latches for securing each sash if operating devices do not include locking features. Provide operating devices for controlling the position of the operative sash, including full open, tight close, and intermediate firm hold. Operating devices must include rotary gears and adjustable operating arms so that even sash contact can be maintained. Provide compression-type weatherstripping.

### 2.2.4 Horizontal-Sliding Windows

Provide latches, pulls, and corrosion resistant steel slides necessary to control and secure window. Provide for cleaning of both sides of sash from inside.

### 2.2.5 Stationary Windows

Provide fixed sash and basic frame in accordance with

AAMA/WDMA/CSA 101/I.S.2/A440.

## 2.3 ACCESSORIES

### 2.3.1 Adhesives

Provide sealants as specified in Section 07 92 00 JOINT SEALANTS.

### 2.3.2 Fasteners

Fasteners and anchors exposed to the environment to be corrosion resistant coated steel, aluminum, or stainless steel compatible with the window material and adjoining construction, and of a type and size recommended by the manufacturer to meet the performance requirements.

## 2.4 FINISHES

### [2.4.1 Paint

Provide windows with factory-primed surfaces which will be exempt from first paint coat application required in Section 09 90 00 PAINTS AND COATINGS.

### ] [2.4.2 Vinyl (PVC) Cladding

Preservative treat all basic wood frame and sash members in accordance with WDMA I.S.4 and Section 06 10 00 ROUGH CARPENTRY, except do not use pentachlorophenol. Clad all exterior surfaces with rigid polyvinyl sheathing, complying with ASTM D1784, class 14344-C, not less than 35 mil average thickness.

### ] [2.4.3 Aluminum Cladding

Preservative treat all basic wood frame and sash members in accordance with WDMA I.S.4, except do not use pentachlorophenol. Clad all exterior surfaces with extruded aluminum with joints sealed during assembly. Aluminum clad frames and sash must meet performance requirements of AAMA/WDMA/CSA 101/I.S.2/A440.

#### 2.4.3.1 Aluminum Finish

Factory finish with [anodic coating] [or] [organic coating].

#### [2.4.3.2 Anodic Coating

Conform to AA DAF45 and AAMA 611. Finish must be [clear (natural), designation AA-M10-C22-A31, Architectural Class II 0.4 mil to 0.7 mil] [clear (natural), designation AA-M10-C22-A41, Architectural Class I 0.7 mil or thicker] [integral color-anodized, designation AA-M10-C22-A32, Architectural Class II 0.4 mil to 0.7 mil] [integral color-anodized, designation AA-M10-C22-A42, Architectural Class I 0.7 mil or thicker] [electrolytically deposited color-anodized designation AA-M10-C22-A34, Architectural Class II 0.4 mil to 0.7 mil] [electrolytically deposited color-anodized, designation AA-M10-C22-A44, Architectural Class I 0.7 mil or thicker]. [ Finish Color: [\_\_\_\_\_] [as indicated].]

#### ] [2.4.3.3 Organic Coating

Clean and prime exposed aluminum surfaces. Provide [baked enamel finish in

accordance with AAMA 2603 with total dry film thickness not less than 0.8 mil] [superior performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 1.2 mils]. Finish color [\_\_\_\_\_] [as indicated].

] 2.5 INSECT SCREENS

ASTM D3656/D3656M, Class 2, 18 by 14 mesh, color [charcoal] [gray] [\_\_\_\_\_] . Aluminum frames to meet SMA 1004.

] PART 3 EXECUTION

3.1 INSTALLATION

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.1.1 Wood Windows

Install in accordance with the approved installation instructions. Securely anchor windows in place. Install and seal windows in a manner that will prevent entrance of water and wind.

[3.1.2 Insect Screen

Install screen panels in accordance with manufacturer's instructions. Install aluminum framed screens in accordance with SMA 1004.

] 3.2 ADJUSTMENTS

Make final adjustment for proper operation of ventilating unit after glazing. Make adjustments to operating sash or ventilators to assure smooth operation. Units must be weathertight when locked closed. Verify products are properly installed, connected, and adjusted.

3.3 CLEANING

Clean windows on both exterior and interior in accordance with manufacturer's recommendations.

-- End of Section --

## SECTION 08 53 00

PLASTIC WINDOWS  
08/20, CHG 1: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

**AAMA 1503** (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

**AAMA/WDMA/CSA 101/I.S.2/A440** (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

**ASHRAE 169** (2013) Climate Data for Building Design Standards

## ASTM INTERNATIONAL (ASTM)

**ASTM D3656/D3656M** (2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

## NATIONAL FENESTRATION RATING COUNCIL (NFRC)

**NFRC 100** (2020) Procedure for Determining Fenestration Product U-Factors

**NFRC 200** (2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

## U.S. DEPARTMENT OF DEFENSE (DOD)

**UFC 4-010-01** (2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

## U.S. DEPARTMENT OF ENERGY (DOE)

**Energy Star** (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Windows; G[, [\_\_\_\_]]

Schedule of Windows; G[, [\_\_\_\_]]

#### SD-03 Product Data

Windows; G[, [\_\_\_\_]]

[ Energy Star Label for Residential Windows; S

] Fasteners

Hardware

Screens

Weatherstripping

Accessories

[ Adhesives

] SD-04 Samples

Windows; G[, [\_\_\_\_]]

#### SD-06 Test Reports

Windows; G[, [\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Windows, Data Package 1; G[, [\_\_\_\_]]

Plastic Identification

#### 1.2.1 Shop Drawing Information

Indicate elevations of windows, full-size sections, thicknesses of PVC, reinforcing members, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attaching screens,] [material and method of attaching subframes,] [fins,] [stools,] [casings,] [sills,] [trim,] accessories, installation details, window flashings and other related items.

Submit schedule of windows with drawings indicating location of each window unit.

#### 1.2.2 Window Samples Information

Submit one full-size window of each type, complete with certification label indicating conformance to [AAMA/WDMA/CSA 101/I.S.2/A440](#), glazing, hardware, [fins,] anchors, and other accessories. [ Where screens or weatherstripping are required, fit sample windows with such items that are to be provided.] After approval, install each sample in the work, clearly identified, and record its location.

#### 1.2.3 Window Test Report Data

Submit for each window type attesting that identical or larger windows have been tested and meet the requirements specified herein for conformance to [AAMA/WDMA/CSA 101/I.S.2/A440](#) and the specified minimum Condensation Resistance Factor (CRF).

#### 1.2.4 Plastic Identification O & M Data

When not labeled, identify types in Operation and Maintenance Manual per paragraph MATERIAL IDENTIFICATION.

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Labels

Each window unit must bear a certification label from an independent, nationally recognized testing organization validating that the product complies with [AAMA/WDMA/CSA 101/I.S.2/A440](#) for the type, grade, and performance class specified.

#### 1.3.2 Certification

Certified test reports attesting that the window units meet the requirements of [AAMA/WDMA/CSA 101/I.S.2/A440](#) as specified will be acceptable in lieu of product labeling or marking.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver windows to the project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the job site. Store windows and components out of contact with the ground, under a weathertight covering, to prevent bending, warping, or otherwise damaging the windows. [ Store windows and components so they will not have to be handled at minus 20 degrees F or colder.] Repair damaged windows to an "as new" condition as approved. Provide new units if windows cannot be repaired.

### 1.5 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except do not apply coatings or lacquers on surfaces to receive caulking and glazing compounds.

### 1.6 MATERIAL IDENTIFICATION

#### 1.6.1 Plastic Identification

Plastic products to be incorporated into the project provide product data indicating polymeric information in Operation and Maintenance Manual.

Type 1: Polyethylene Terephthalate (PET, PETE).

Type 2: High Density Polyethylene (HDPE).

Type 3: Vinyl (Polyvinyl Chloride or PVC).

Type 4: Low Density Polyethylene (LDPE).

Type 5: Polypropylene (PP).

Type 6: Polystyrene (PS).

Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

## 1.7 WINDOW PERFORMANCE

Provide vinyl windows meeting the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

### 1.7.1 Thermal Performance

Windows (including frames and glass) will be independently tested and certified with a Solar Heat Gain Coefficient (SHGC) determined according to NFRC 200 procedures and a whole window U-factor determined in accordance with NFRC 100 within the ranges as indicated below according to the ASHRAE 169 Climate Zone of the project location. [ Windows used solely within the interior of a conditioned envelope are exempted from meeting U-Factor and SHGC requirements, unless otherwise noted.] Provide visual Transmittance (VT) of 0.5 or greater.

[ Residential glazed systems (including frames and glass) must be Energy Star label for residential windows labeled products for the [Northern] [North-Central] [South-Central] [Southern] climate zone. Provide proof of Energy Star label for residential windows.

#### ] [1.7.1.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [0.40] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

#### ] [1.7.1.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

#### ] [1.7.1.3 North-Central Climate

Windows installed within Climate Zone 4 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.40] [\_\_\_\_\_] or less.

#### ] [1.7.1.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.27] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less. There is no SHGC limit for this climate zone.



## ] [1.7.1.5 Non-residential Windows

Non-residential glazed systems (including frames and glass) must be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] determined according to NFRC 200 procedures and a U-factor maximum of [\_\_\_\_\_] Btu per square foot by ht by degree F in accordance with NFRC 100.

## ] PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS FOR WINDOWS

Provide windows conforming to AAMA/WDMA/CSA 101/I.S.2/A440 and to requirements specified herein. Provide windows of materials, types, grades, performance classes, combinations and sizes indicated or specified. Provide each window as a unit consisting of [subframe,] frame, sash, glass, hardware, [mullions,] [fins,] [trim,] [casing,] [screen,] [weatherstripping,] anchors and accessories complete. Design windows to accommodate glass, hardware, [screens,] [weatherstripping,] and accessories to be furnished. Provide factory or field installed glass. Provide windows with a minimum CRF of [\_\_\_\_\_] when tested in accordance with AAMA 1503.

## 2.2 MATERIALS

## 2.2.1 Windows

Provide PVC, reinforcing members, fasteners, hardware, weatherstripping, and anchors conforming to AAMA/WDMA/CSA 101/I.S.2/A440 and as specified herein.

## 2.2.2 Glass and Glazing

As specified in Section 08 81 00 GLAZING.

## 2.2.3 Caulking and Sealing

As specified in Section 07 92 00 JOINT SEALANTS.

## 2.2.4 Adhesives

Provide sealants as specified in Section 07 92 00 JOINT SEALANTS.

## 2.2.5 Insect Screening

ASTM D3656/D3656M, Class 2, 18 by 14 mesh, color [charcoal] [gray] [\_\_\_\_\_].

## 2.2.6 Accessories

As standard with the manufacturer and as specified herein.

## 2.3 WINDOW TYPES

Provide windows of the following types, as indicated.

## 2.3.1 Awning Windows

AAMA/WDMA/CSA 101/I.S.2/A440, Type A- [R 15] [C 20] [[\_\_\_\_\_] (Optional

Performance Class)]. Provide compression-type weatherstripping.

#### 2.3.2 Casement Windows

AAMA/WDMA/CSA 101/I.S.2/A440, Type C- [R 15] [C 20] [HC 40] [[\_\_\_\_\_] (Optional Performance Class)]. Provide [rotary crank] [handle] operated ventilators. Provide ventilators over 66 inches high with two separate locking devices or a two-point locking device operated by rods from a single lever handle. Conceal rods where possible. Provide compression-type weatherstripping. [ Provide casement windows in combination with [fixed] [projected] windows specified below.]

#### 2.3.3 Hung Windows

AAMA/WDMA/CSA 101/I.S.2/A440, Type H- [R 15] [(Optional Performance Class)].

#### 2.3.4 Horizontal Sliding Windows

AAMA/WDMA/CSA 101/I.S.2/A440, Type HS- [R 15] [(Optional Performance Class)].

#### 2.3.5 Projected Windows

AAMA/WDMA/CSA 101/I.S.2/A440, Type P- [R 15] [(Optional Performance Class)]. Provide projected windows with concealed four bar friction hinges only.

#### 2.3.6 Fixed Windows

AAMA/WDMA/CSA 101/I.S.2/A440, Type F- [R 15] [(Optional Performance Class)].

#### 2.3.7 Dual Action (Tilt/Turn) Windows

Provide dual action windows with a ventilator which swings into the room from the top for ventilation and swings in from the side for cleaning of the outside surface. When swung from the side, the ventilator must swing in sufficiently to allow safe access to the outside surface.

##### 2.3.7.1 Construction

Provide ventilators with one or more stabilizing arms attached to the frame when ventilator is opened from top. When ventilator is in the tilt-open position, stabilizing arms must provide positive positioning of the ventilator.

##### 2.3.7.2 Hardware

Equip each ventilator with one handle to provide both tilt and swing operation. The tilt or swing operation must be individually selected and rendered operable starting only from the closed sash position. Provide a secondary locking device for each ventilator to prevent accidental swing operation.

##### 2.3.7.3 Performance Requirements

Provide dual action windows to meet the primary performance requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440 for Grade and Performance Class [R 15] [(Optional Performance Class)].

## 2.4 FABRICATION

Conform to [AAMA/WDMA/CSA 101/I.S.2/A440](#) and to the requirements specified herein.

### 2.4.1 Subframes, Mullions and Transom Bars

Provide subframes, transom bars and mullions between multiple window units which meet the design pressure of [15] [20] [40] [\_\_\_\_\_] pounds per square foot (psf). Fabricate mullions and transom bars in such a manner as to permit expansion and contraction between adjoining construction and window units and to form a weathertight joint.[ Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.][ Provide special covers over structural support at mullions as indicated.]

### 2.4.2 Combination Windows

Provide factory assembled combination windows of the same grade and performance class. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

### 2.4.3 Frames and Sash

#### 2.4.3.1 Corners and Reinforcement

Provide [mechanically fixed and sealed or welded] [welded] corners on PVC frames and sashes. Reinforce frames and sash as necessary to meet the requirements for the performance classes or grades specified herein.

#### 2.4.3.2 Adjustability

Ventilating sash must be adjustable vertically and horizontally to ensure smooth operation.

#### 2.4.3.3 Drips and Weep Holes

[Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, provide continuous drips across tops of fixed windows. ]Provide drips and weep holes as required to return water to the outside.

#### 2.4.3.4 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown [or specified]. Design sash for [inside] [outside] [single] [double] [triple] glazing and for securing glass with [glazing beads,] [glazing clips,] [glazing channels,] [glazing gaskets,] [or glazing compound]. [ For windows required to comply with antiterrorism provisions, design in accordance with Standard 10 of [UFC 4-010-01](#).]

### 2.4.4 Hardware

The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip operating ventilators with a lock or latching device which can be secured from the inside.

#### 2.4.5 Weatherstripping

Provide for ventilating sections of windows to ensure a weathertight seal meeting the infiltration requirements specified in [AAMA/WDMA/CSA 101/I.S.2/A440](#). Provide easily replaceable factory-applied weatherstripping.

#### 2.4.6 Screens

Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware.

#### 2.4.7 Color

Provide [white] [\_\_\_\_\_] window PVC color. Color must be integral or co-extruded to the PVC to prevent heat build-up.

#### 2.4.8 Fasteners

Provide fastener types as standard with the window manufacturer for windows, trim, and accessories. Fasteners exposed to the environment to be corrosion resistant coated steel, aluminum, or stainless steel compatible with the window material and adjoining construction, and of a type and size recommended by the manufacturer to meet the performance requirements.

#### 2.4.9 Accessories

Provide windows complete with clips, fins, anchors, [grills,] [venetian blinds,] and other appurtenances necessary for complete installation and proper operation.

##### 2.4.9.1 Anchors

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Provide corrosion resistant anchors and fasteners compatible with the window and the adjoining construction. For each jamb **36 inches** or longer, provide a minimum of three anchors located approximately **6 inches** from each end and at midpoint. For jambs less than **36 inches** long, provide two anchors.

##### 2.4.9.2 Grills

Provide the manufacturer's standard grills for the windows indicated. Grills must be removable type or sealed within insulating glass units. Provide manufacturer's standard grill pattern design or as approved, unless otherwise indicated.

##### [2.4.9.3 Integral Venetian Blinds

Provide the manufacturer's standard venetian blinds mounted within the window frame for the windows indicated. Venetian blinds must be fully adjustable allowing full angle tilting and stops at any position. Provide [white ]blinds[ to match color of the PVC].

### ]PART 3 EXECUTION

#### 3.1 INSTALLATION

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and seal windows in a manner that will prevent entrance of water and wind. [ Fasten insect screens securely in place.] Fasten hardware to windows.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

### 3.1.1 Anchors and Fastenings

Secure units to each other, to masonry, and to other adjoining construction with clips, fins, screws, or other devices recommended by the window manufacturer.

### 3.2 ADJUSTING

After installation of windows and completion of glazing and field painting, adjust ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Verify products are properly installed, connected, and adjusted.

### 3.3 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weatherstripping, and to prevent interference with operation of hardware. Replace stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

### 3.4 PROTECTION

Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame.

-- End of Section --

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## SECTION 08 56 53

## BLAST RESISTANT TEMPERED GLASS WINDOWS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum

AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

AAMA WSG.1 (1995) Window Selection Guide

AAMA/WDMA/CSA 101/I.S.2/A440 (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 169 (2013) Climate Data for Building Design Standards

## ASTM INTERNATIONAL (ASTM)

ASTM C509 (2006; R 2021) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material

ASTM C920 (2018) Standard Specification for

## Elastomeric Joint Sealants

ASTM C1048	(2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass
ASTM F2912	(2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings

## GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2008) Glazing Manual
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## NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2020) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

## PASSIVE HOUSE INSTITUTE - US (PHIUS)

PHIUS Certified	Certified Data Program for Window Performance
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## PASSIVE HOUSE INSTITUTE INTERNATIONAL (PHI)

Passivhaus Certified	(2012) Certification of Passive House Suitable Components
Passivhaus Criteria	(2012) Certification Criteria for



Certified Passive House Glazings and  
Transparent Components

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01

(2018; with Change 1, 2020) DoD Minimum  
Antiterrorism Standards for Buildings

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star

(1992; R 2006) Energy Star Energy  
Efficiency Labeling System (FEMP)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Windows; G[, [\_\_\_\_]]

Fabrication Drawings

### SD-03 Product Data

Window Units; G[, [\_\_\_\_]]

Hardware

Setting Materials

Weatherstripping

### SD-04 Samples

Finish Sample

Window Sample

[ Window Mock-Ups; G[, [\_\_\_\_]]

### ] SD-05 Design Data

Structural Calculations for Deflection; G[, [\_\_\_\_]]

Design Analysis; G[, [\_\_\_\_]]

### SD-06 Test Reports

Minimum Condensation Resistance Factor

[ Resistance to Forced Entry

] [ Standard Airblast Test; G[, [\_\_\_\_]]

] [ Windborne-Debris-Impact Performance  
] SD-07 Certificates  
[ Engineer's Qualifications  
] SD-08 Manufacturer's Instructions  
Glass  
SD-10 Operation and Maintenance Data  
Window Units, Data Package 1; G[, [\_\_\_\_\_]]

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualification of Manufacturer

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of [\_\_\_\_\_] years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

#### 1.3.2 Shop Drawing Requirements

Take field measurements prior to preparation of drawings and fabrications. Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attaching screens,] [material and method of attaching subframes,] [stools,] [casings,] [sills,] [trim,] [window cleaner anchors,] installation details, and other related items.

#### [1.3.3 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

#### ]1.3.4 Sample Requirements

##### 1.3.4.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

##### 1.3.4.2 Window Sample Requirements

[ Submit one full-size window of each type proposed for use, complete with AAMA Label, glazing, hardware, anchors, and other accessories. Where screens or weatherstripping is required, fit sample windows with such items that are to be used. After approval, install each sample in work, clearly identified, and record its location.

] [Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

] [1.3.4.3 Window Mock-Ups

Before fabrication, full-size mock-up of [each type of aluminum window] [one window unit] [\_\_\_\_\_] complete with glass and AAMA certification label for structural purposes and NFRC Temporary and Permanent Label for certification of thermal performance rating will be required for review of window construction and quality of hardware operation.

] 1.3.5 Design Data Requirements

Submit [structural calculations for deflection](#) to substantiate compliance with requirements [ and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations. Submit [design analysis](#) with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure [.] [meets the requirements of paragraph ANTITERRORISM PERFORMANCE REQUIREMENTS.] Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

1.3.6 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to [AAMA/WDMA/CSA 101/I.S.2/A440](#) including test size, [and] [minimum condensation resistance factor](#) (CRF) [, and [resistance to forced entry](#)] [, and, for Antiterrorism windows, in lieu of a Design Analysis, results of a [Standard Airblast Test](#)]. [ For Antiterrorism windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shock tube, must be included in a test report, providing information in accordance with [ASTM F1642/F1642M](#), as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph STANDARD AIRBLAST TEST METHOD.]

1.3.7 Certification

Ensure that construction is performed with products that meet or exceed [ [Energy Star](#) criteria,] [FEMP Designated criteria,] [and [Passivhaus Criteria](#)] [[Passivhaus Certified](#)] [and be current in their certification]. [ Provide [PHIUS Certified](#) window performance.] Each prime window unit must bear the AAMA Label warranting that the product complies with [AAMA/WDMA/CSA 101/I.S.2/A440](#). Certified test reports attesting that the prime window units meet the requirements of [AAMA/WDMA/CSA 101/I.S.2/A440](#), including test size, will be acceptable in lieu of product labeling.

1.3.8 Label

Each prime window unit must bear the AAMA Label warranting that the product complies with [AAMA/WDMA/CSA 101/I.S.2/A440](#). Certificates of Compliance attesting that the prime window units meet the requirements of [AAMA/WDMA/CSA 101/I.S.2/A440](#) will be acceptable in lieu of product labeling.

### 1.3.9 Glass and Glazing

Provide materials that are certified to meet ANSI Z97.1 by an independent testing laboratory.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- a. Deliver products to the site in unopened containers, labeled plainly with manufacturers' name and brands. Deliver window assemblies in an undamaged condition. Exercise care in handling and hoisting windows during transportation and at the job site. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows.
- b. Finished surfaces must be protected during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which sealants, caulking, or glazing compounds must adhere.

### 1.5 ENVIRONMENTAL CONDITIONS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising unless approved provisions are made to warm the glass and rabbet surfaces. Provide sufficient ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work if moisture collects on window assemblies or during rainy weather.

### 1.6 PERFORMANCE REQUIREMENTS

#### 1.6.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least [\_\_\_\_\_] pounds per square foot (psf).

#### [1.6.2 Tests

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

[ Test projected windows in accordance with the applicable portions of the AAMA WSG.1 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

] [Test double-hung windows in accordance with the applicable portions of the AAMA WSG.1 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

#### ]]1.7 DRAWINGS

Submit the [fabrication drawings](#) for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

## 1.8 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

### 1.8.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by [AAMA/WDMA/CSA 101/I.S.2/A440](#) for the window types and classification specified in this section.

#### [1.8.2 Antiterrorism Performance Requirements

Windows must meet the antiterrorism performance criteria as specified in the paragraphs below in accordance with [UFC 4-010-01](#). Conformance to the performance requirements must be validated by one of the following methods.

##### 1.8.2.1 Computational Design Analysis Method

Design window assembly to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window assembly proposed for use, under the given static equivalent loads.

Design window frames, mullions, sashes, and glazing to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window system proposed for use, under the given static equivalent loads.

Glazing resistance must be greater than equivalent 3-second duration loading of [\_\_\_\_\_] [pounds per square foot \(psf\)](#) for type [\_\_\_\_\_] window[ and [\_\_\_\_\_] [psf](#) for the remaining window types]. The glazing frame bite for the window frames must be in accordance with [ASTM F2248](#).

Design Aluminum/Steel window framing members to restrict deflections of the edges of glazing they support to L/60 under two times (2X) the glazing resistance per the requirements of [ASTM F2248](#) and [ASTM E1300](#).

[ Anchor window frames to the supporting structure with anchors designed to resist [two times (2X)] [one time (1X)] the glazing resistance in accordance with [ASTM F2248](#) and [ASTM E1300](#).

##### ]1.8.2.2 Dynamic Design Analysis Method

Design window assembly using a dynamic analysis to prove the system will provide performance equivalent to or better than a [low;] [very low;] [\_\_\_\_\_] hazard rating in accordance with [ASTM F2912](#) for the peak positive pressure of [\_\_\_\_\_] [pounds per square inch \(psi\)](#) and peak positive phase impulse of [\_\_\_\_\_] [pounds per square inch - millisecond \(psi-msec\)](#). Use a triangular blast load using the applicable pressure and impulse indicated

above. The allowable response limits of [aluminum] [steel] frame elements are as follows: Maximum ductility ratio of [\_\_\_\_\_] and maximum support rotation of [\_\_\_\_\_] degrees.

#### 1.8.2.3 Standard Airblast Test Method

As an alternative to the 'Computational Design Analysis Method' and 'Dynamic Design Analysis Method' indicated above, window [\_\_\_\_\_] assembly may be tested for evaluation of hazards generated from airblast loading in accordance with [ASTM F1642/F1642M](#) by an independent testing agency regularly engaged in blast testing. For proposed window systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed window size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems in accordance with [ASTM F2912](#). Proposed window system/assembly of a size outside this range will require testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. Perform the test on the entire proposed window system/assembly, including, the glazing, its framing/support system, operating devices, and all anchorage devices. Window support system replicate anchorage of the window support system with the method of installation to be used for the project. The minimum airblast loading parameters for the test will be as follows: peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). The hazard rating for the proposed window systems, as determined by the rating criteria of [ASTM F2912](#), to provide performance equivalent to or better than a [low;] [very low;] [\_\_\_\_\_] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard", "Very Low Hazard" and "Low Hazard" ratings are acceptable. "High Hazard" ratings are unacceptable. Results of window systems previously tested by test protocols other than [ASTM F1642/F1642M](#) may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

#### ]1.8.3 Air Infiltration

Air infiltration must not exceed the amount established by [AAMA/WDMA/CSA 101/I.S.2/A440](#) for each window type.

#### 1.8.4 Water Penetration

Water penetration must not exceed the amount established by [AAMA/WDMA/CSA 101/I.S.2/A440](#) for each window type.

#### 1.8.5 Thermal Performance

Windows (including frames and glass) will be independently tested and certified with a Solar Heat Gain Coefficient (SHGC) determined according to [NFRC 200](#) procedures and a whole window U-factor determined in accordance with [NFRC 100](#) within the ranges as indicated below according to the [ASHRAE 169](#) Climate Zone of the project location. [ Windows used solely within the interior of a conditioned envelope are exempted from meeting U-Factor and SHGC requirements, unless otherwise noted.] Provide visual Transmittance (VT) of 0.5 or greater. Submit documentation supporting compliance with [Energy Star](#), FEMP designated, and Passive House qualifications as applicable. Provide proof of [Energy Star](#) label for residential aluminum window products.

## ]1.8.5.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [0.40] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

## ]1.8.5.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.25] [\_\_\_\_\_] or less.

## ]1.8.5.3 North-Central Climate

Windows installed within Climate Zone 4 will have a U-Factor of [0.30] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.36] [\_\_\_\_\_] or less.

## ]1.8.5.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.27] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less and a SHGC of [0.36] [0.41] [\_\_\_\_\_] or less.

## ]1.8.5.5 Subarctic Climate

Windows installed within Climate Zone 8 will have a U-Factor of [0.08] [0.22] [\_\_\_\_\_] BTU/h·ft<sup>2</sup>·degrees F or less. There is no SHGC limit for this climate zone.

## ]1.8.6 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

a. Refer to drawings for classification of window requiring basic or enhanced protection.

[ b. Large-Missile Test: For glazing located within 30 feet of grade.

]c. Small-Missile Test: For glazing located more than 30 feet above grade.

## ]1.9 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

## PART 2 PRODUCTS

## 2.1 WINDOW UNITS

Primed window frames must conform to AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. Provide windows of types, grades, performance classes, combinations, and sizes indicated or specified. Provide windows to accommodate hardware, glass, weatherstripping and accessories. Each window must be a complete factory-assembled unit with

glass factory or field installed.

## 2.2 WEATHERSTRIPPING

Weatherstripping must conform to [AAMA/WDMA/CSA 101/I.S.2/A440](#).

## 2.3 GLASS

Use [ASTM C1048](#) and [ANSI Z97.1](#) Grade B (tempered), Style I (uncoated), Type 2, Class [1 (transparent)] [2 (heat absorbing)].

## 2.4 SETTING MATERIALS

Provide types required for the applicable setting method specified in the [GANA Glazing Manual](#), unless specified otherwise herein. Do not use metal sash putty, non-skinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted must be [gray,] [black] or neutral color.

### 2.4.1 Elastomeric Sealant

[See Section [07 92 00 JOINT SEALANTS](#) for sealant requirements.] [[ASTM C920](#), Type S or M, Grade NS, Class 12.5, Use NT. Use for channel or stop glazing [and] [metal] sash. Sealant must be chemically compatible with setting blocks, edge blocks, and sealing tapes. Color of sealant must be [as selected] [gray] [black] [white] [\_\_\_\_\_].]

### 2.4.2 Sealing Tapes, Beads or Gaskets

Gaskets or beads must be at least [3/8 inch](#) wide with a Shore "A" durometer hardness of 50 and conform to [ASTM C509](#).

### 2.4.3 Setting Blocks and Edge Blocks

Use neoprene of 70 to 90 Shore "A" durometer hardness, chemically compatible with sealants used, and of sizes recommended by the glass manufacturer.

### 2.4.4 Accessories

Use accessories as required to provide a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

## 2.5 WINDOW ASSEMBLIES

Window units must conform to [AAMA/WDMA/CSA 101/I.S.2/A440](#).

### 2.5.1 Provisions for Glazing

Provide windows and rabbets suitable for specified glass thickness. [Minimum edge clearance must be [\_\_\_\_\_]. Nominal bite must be [\_\_\_\_\_]. Minimum face clearance must be [\_\_\_\_\_].] Provide sash for glazing and for securing glass with [metal beads] [glazing clips] [glazing channels] and glazing compound.

### 2.5.2 Sealant, Gaskets, and Beads



Sealant, gaskets, and beads must be continuous around the perimeter of the glass.

### 2.5.3 Weatherstripping

Provide for ventilating sections of windows to ensure a weathertight seal meeting the infiltration requirements specified in [AAMA/WDMA/CSA 101/I.S.2/A440](#). Provide factory-applied weatherstripping that can be replaced by field repair mechanics. Use molded vinyl, molded or molded-expanded neoprene for weatherstripping for compression contact surfaces. Do not use neoprene or polyvinyl chloride weatherstripping where it will be exposed to direct sunlight.

### 2.5.4 Fasteners

Provide flathead, cross-recessed type, exposed head screws and bolts with standard threads for use on windows, trim, and accessories. Screw heads must finish flush with adjoining surfaces. Screws and bolts exposed to the environment to be corrosion resistant coated steel, aluminum, or stainless steel compatible with the window material and adjoining construction, and of a type and size recommended by the manufacturer to meet the performance requirements. Self-tapping sheet-metal screws are not acceptable for material more than  $1/16$  inch thick.

### 2.5.5 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

### 2.5.6 Combination Windows

Windows used in combination must be the same grade and performance class and must be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

### 2.5.7 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

### 2.5.8 Hardware

The item, type, and functional characteristics must be the manufacturer's standard for the particular window type and must conform to [AAMA/WDMA/CSA 101/I.S.2/A440](#). Provide hardware that functions after the window assembly has withstood the application of the design blast pressure causing the development of a static design resistance,  $r_u$ , uniformly applied over both glazing and frame as defined in paragraph CERTIFICATES OF COMPLIANCE of this section. Equip operating ventilators with a lock or latching device which can be secured from the inside.

### 2.5.9 Anchors

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Provide corrosion

resistant anchors and fasteners compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

#### 2.5.10 Window Cleaner Anchors

Provide double-head anchors for windows [indicated] [specified]. Anchors must be stainless steel of size and design required for the window type and application. Provide two anchors for each single window[ and each adjacent glass window unit]. Fasten anchors 44 inches above the window sill utilizing appropriate methods for the window type and application in accordance with industry safety standards.

#### 2.5.11 Finishes

Exposed aluminum surfaces must be factory finished with an [anodic coating] [or] [organic coating]. [ Color must be [\_\_\_\_\_] [as indicated].] Windows [for each building] must have the same finish.

##### 2.5.11.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

- [ a. Architectural Class II ( 0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color] anodized.
- ] [b. Architectural Class I ( 0.7 mil or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.

##### ]2.5.11.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a [baked enamel finish in accordance with AAMA 2603 with total dry film thickness not less than 0.8 mil] [superior performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 1.2 mils].

#### 2.6 SOURCE QUALITY CONTROL

##### 2.6.1 Window Assembly Structural Test

###### 2.6.1.1 Test Sample Number

At least two sample window assemblies for each type of window provided must be tested, under an increasing uniform static load. Number of samples, beyond two, is left up to the vendor. However, it is noted that the acceptance criteria encourages a larger number of test samples.

###### 2.6.1.2 Test Procedure

Test windows (glass panes and support frame) must be identical in type, size, sealant, gasket or bead and construction to those furnished by the window manufacturer. The frame assembly in the test setup must be secured by boundary conditions that simulate the adjoining walls of the structure for intended installation. The simulation securing boundary conditions must be verified and attested by an attending Professional Engineer. Using either a vacuum or a liquid-filled bladder, an increasing uniform load must

be applied to the entire window assembly (glass and frame) until failure occurs in either the glass or frame. Failure must be defined as either breaking of glass or loss of frame resistance. The failure load,  $r_f$ , must be recorded to three significant figures. The load should be applied at a rate of 0.5 ru per minute where ru is the static design resistance:

<u>Glass Size</u>	<u>Static Design Resistance</u>
[_____] by [_____] inch	[_____] psi

2.6.1.3 Acceptance Criteria

The static load capacity ( $r_s$ ) of a glass pane for the specified acceptance test procedure is:

$$r_s = 0.876 r_u \tag{1}$$

The window assembly (frame and glass) is considered acceptable when the arithmetic mean of all the samples tested,  $r^-$  such that:

$$r^- \Rightarrow r_s \text{ plus } sA \tag{2}$$

where:  $r_s$  = static load capacity of the glass pane for certification testing  
 $s$  = sample standard deviation  
 $A$  = acceptance coefficient (Table 1)

- a. Arithmetic mean/standard deviation: For  $n$  test samples,  $r^-$  is defined as:

$$r^- = \text{sum from } i = 1 \text{ thru } n \text{ for } r_{fi} \text{ divided by } n \tag{3}$$

where  $r_{fi}$  is the recorded failure load of the  $i$ th test sample.

The sample standard deviation,  $s$ , is defined as:

$$s = \text{the square root of the quantity of the sum from } i = 1 \text{ thru } n \text{ for } (r_{fi} - r^-)^2 \text{ divided by } (n - 1) \tag{4}$$

The minimum value of the sample standard deviation,  $s$ , permitted to be employed in Equation (2) is:

$$s = 0.145 r_s \tag{5}$$

This assures a sample standard deviation no better than observed for the general population of tempered glass.

- b. Additional sampled determination: The following equation can be used by tester to determine if additional test samples are justified. If:

$$r^- \leq r_s \text{ plus } sB \tag{6}$$

then with 90 percent confidence, the design will not prove to be adequate with additional tests. Obtain rejection coefficient,  $B$ , from Table 1.

Table 1. Statistical Acceptance and Rejection Coefficients		
Number of Window Assemblies, n	Acceptance Coefficient, A	Rejection Coefficient, B
2	4.14	.546
3	3.05	.871
4	2.78	1.14
5	2.65	1.27
6	2.56	1.36
7	2.50	1.42
8	2.46	1.48
9	2.42	1.49
10	2.39	1.52
11	2.37	1.54
12	2.35	1.57
13	2.33	1.58
14	2.32	1.60
15	2.31	1.61
16	2.30	1.62
17	2.38	1.64
18	2.27	1.65
19	2.27	1.65
20	2.26	1.66
21	2.25	1.67
22	2.24	1.68
23	2.24	1.68
24	2.23	1.69

Table 1. Statistical Acceptance and Rejection Coefficients		
Number of Window Assemblies, n	Acceptance Coefficient, A	Rejection Coefficient, B
25	2.22	1.70
30	2.19	1.72
40	2.17	1.75
50	2.14	1.77

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Set windows at proper elevation, location, and reveal. Brace properly to prevent distortion and misalignment. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water. Fasten hardware to windows.

##### 3.1.2 Glass Setting

Items to be glazed must be either shop or field glazed using glass of the quality and thickness specified or indicated. Preparation and glazing, unless otherwise approved, must conform to applicable recommendations in the [GANA Glazing Manual](#). Windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops furnished with items to be glazed, to secure glass in place.

##### 3.1.3 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to, masonry, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface must be protected from dissimilar materials as recommended in the Appendix to [AAMA/WDMA/CSA 101/I.S.2/A440](#). Do not coat surfaces on which sealants are to adhere.

##### 3.1.4 Anchors and Fastenings

Make provision for securing units to each other and to adjoining construction.

##### 3.1.5 Adjustments After Installation

After installation of windows and completion of glazing and field painting,

adjust ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as recommended by the manufacturer.

### 3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weatherstripping, and to prevent interference with the operation of hardware. Remove stained, discolored, or abraded windows that cannot be restored to their original condition, and replace with new windows.

-- End of Section --

## SECTION 08 56 63

## DETENTION AND SECURITY WINDOWS

04/06

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

## ASTM INTERNATIONAL (ASTM)

ASTM A90/A90M (2021) Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A239 (2021) Standard Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles

ASTM A627 (2003; R 2011) Standard Specification for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM B766	(1986; R 2015) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

## STEEL WINDOW INSTITUTE (SWI)

SWI AGSW	(2002) Architect's Guide to Steel Windows
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Window Units

Indicate the elevations of windows, half-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, the size and spacing of anchors, details of construction, method of glazing, mullion details, casings, sills, trim, other related items, and installation details.

## SD-03 Product Data

## Window Units

## Fasteners

## Accessories

Include finishes.

## SD-06 Test Reports

## Air Infiltration

## Water infiltration



## Mullion and Transom Bar Wind Load

## 1.3 QUALITY ASSURANCE

The requirements specified in this section govern where there is a difference between this section and the referenced industry specifications.

## 1.3.1 Test Reports

## 1.3.1.1 Air and Water Infiltration Tests

ASTM E283 and ASTM E331. Air infiltration shall not exceed one-half cubic foot per minute per foot of crack length when subjected to a static pressure of 1.56 pounds per square foot (equivalent to a wind velocity of 25 miles per hour). The amount of water infiltration shall be "zero" when tested in accordance with ASTM E331.

## 1.3.1.2 Mullion and Transom Bar Wind Load Tests

ASTM E330/E330M. Members shall withstand a uniform wind load of 20 pounds per square foot of window area without deflecting more than 1/175 of the span.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver windows to project site in an undamaged condition. Store windows and components at the site on edge, out of contact with the ground, and under a weathertight covering.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Steel Bars

SWI AGSW.

## 2.1.2 Sheet Steel

ASTM A1011/A1011M.

## 2.1.3 Zinc-Coated Sheet Steel

ASTM A653/A653M.

## 2.1.4 Zinc-Coated Steel

ASTM A90/A90M, ASTM A123/A123M or ASTM A153/A153M.

## 2.1.5 Corrosion Resisting Sheet Steel

ASTM A167.

## 2.1.6 Screws and Bolts

ASTM B766 or ASME B18.6.3, as applicable.

## 2.2 WINDOW UNITS

Units shall conform to the SWI AGSW, except as modified herein.

## 2.3 FABRICATION

Form permanent joints by welding or by mechanically fastening as specified [for each type window]. Use joints of strength required to maintain the structural value of members connected. Weld joints solid, remove excess metal, and dress smooth on exposed and contact surfaces. Closely fit joints formed with mechanical fastenings and make permanently watertight. Assemble frames at the plant, and ship as a unit with hardware unattached.

### 2.3.1 Window Sections

Where fixed window sections adjoin, provide a fixed sash, fabricated from similar frame members and of the manufacturer's standard type suitable for the purpose. [Roll weathering surfaces integrally to provide two-point, parallel-surface contact with an overlap at both inside and outside points of closure.]

### 2.3.2 Drainage Holes

Provide drips and weep holes, as required, to return water to outside, minimum of two per window.

### 2.3.3 Fasteners

Use flat or oval head spanner, twist-off or safety head screws and bolts with standard threads on windows, trim and accessories. Self tapping sheet-metal screws are not acceptable.

### 2.3.4 Fastener Finish

Fabricate windows with hot-dipped galvanized finish, using stainless steel or hot-spun galvanized steel fasteners. Use heavily cadmium plated steel fasteners for windows with painted finish or electrogalvanized in accordance with ASTM A239. Finish exposed heads of fasteners to match finish of windows.

### 2.3.5 Frames

Form frames from low carbon steel not less than 12 U.S. gage. Frames shall be one piece, channel shaped sections, at each jamb and between jamb at head and sill. Cope or miter and weld frame members at corners full depth of the frame for maximum strength and weathertightness; dress exposed welds smooth. Provide frame members with dimensions and profiles indicated. Provide 3/8 by 2 1/4 inch, tool resistant steel flats conforming to ASTM A627, penetrated by 7/8 inch tool-resistant steel rounds conforming to ASTM A627 in frame members.

## 2.4 PROVISIONS FOR GLAZING

Design for outside single glazing and for securing glass with metal beads and glazing compound. Glazing specified in Section 08 88 53 DETENTION AND SECURITY GLAZING.

## 2.5 SCREENS

Provide manufacturer's standard screens for window units with movable sash, galvanized frame.

## 2.6 ACCESSORIES

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation of windows.

## 2.7 ANCHORS

Use hot-dip, zinc-coated steel anchors of the type indicated or specified. Use cadmium or zinc-coated nuts, bolts, and other fasteners for ferrous material.

## 2.8 SHOP PRIMED FINISH

After fabrication, clean surfaces of windows, fins, mullions, cover plates [and screen frames], provide a hot-dip galvanized, phosphate-treated and shop primed finish. The methods of cleaning, chemical treating, galvanizing, and painting shall conform to SWI AGSW. Windows shall receive finish paint coats as specified in Section 09 90 00 PAINTS AND COATINGS.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install windows in accordance with the manufacturer's printed instructions and details, except as specified otherwise in this section. Build in windows as the work progresses. Set windows at indicated elevation, location, and reveal. Set plumb, square, level, and in alignment. Brace, strut, and stay to prevent distortion and misalignment.

### 3.2 ANCHORS AND FASTENINGS

Place anchorage as wall construction progresses. Build in anchors or bolt anchors and fastenings to the jambs of openings and weld securely to the windows or frames and to the adjoining construction. Space anchors not more than 16 inches apart on jambs, and install a minimum of four anchors on each side of each opening. Anchors and fastenings shall have sufficient strength to hold the member firmly in position.

### 3.3 SEALANTS

Section 07 92 00 JOINT SEALANTS.

### 3.4 CLEANING

Clean metal surfaces of windows, inside and outside, of mortar, plaster, paint, and other foreign matter to present a neat appearance and to prevent fouling of weathering surfaces. Clean and touch-up abraded surfaces of steel windows. Replace stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

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## SECTION 08 60 45

[SKYLIGHTS] [ AND ] [TRANSLUCENT PANELS]

08/20

## PART 1 GENERAL

## 1.1 SUMMARY

Provide commercially available [roof windows] [unit skylights [flat glass] [domed] [pyramidal] [vaulted]] [metal or wood framed skylights] which satisfy all requirements contained in this section and have been verified by load testing and independent design analyses (if required) to meet specified design requirements. Provide UV-stabilized, shatterproof and energy efficient skylight systems. Provide light transmitting plastics in the manufacturing of skylights for daylighting applications. Systems must meet requirements of [UFC 4-010-01](#).

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

[AA DAF45](#) (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

[AAMA 611](#) (2014) Voluntary Specification for Anodized Architectural Aluminum

[AAMA 2603](#) (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

[AAMA 2605](#) (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

[AAMA/WDMA/CSA 101/I.S.2/A440](#) (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## ASTM INTERNATIONAL (ASTM)

[ASTM C297/C297M](#) (2016) Flatwise Tensile Strength of Sandwich Constructions

[ASTM D572](#) (2004; R 2019) Rubber Deterioration by Heat and Oxygen

[ASTM D635](#) (2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning

	of Plastics in a Horizontal Position
ASTM D1002	(2010; R 2019) Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
ASTM D1003	(2013) Haze and Luminous Transmittance of Transparent Plastics
ASTM D1037	(2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D1929	(2020) Standard Test Method for Determining Ignition Temperature of Plastics
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2843	(2019) Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
ASTM D3841	(2016) Standard Specification for Glass Fiber-Reinforced Polyester Plastic Panels
ASTM E72	(2015) Conducting Strength Tests of Panels for Building Construction
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E108	(2020a) Standard Test Methods for Fire Tests of Roof Coverings
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E661	(2003;R 2015; E 2015) Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under

## Concentrated Static and Impact Loads

- ASTM E695** (2003; R 2015; E 2015) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
- ICC EVALUATION SERVICE, INC. (ICC-ES)
- ICC-ES AC04** (2012; R 2015) Acceptance Criteria for Sandwich Panels
- INTERNATIONAL CODE COUNCIL (ICC)
- ICC IBC** (2018) International Building Code
- NATIONAL FENESTRATION RATING COUNCIL (NFRC)
- NFRC 100** (2020) Procedure for Determining Fenestration Product U-Factors
- NFRC 200** (2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
- U.S. DEPARTMENT OF DEFENSE (DOD)
- UFC 4-010-01** (2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings
- U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
- 29 CFR 1910.23** (Nov 2016) Ladders
- UNDERWRITERS LABORATORIES (UL)
- UL 972** (2006; Reprint Nov 2020) UL Standard for Safety Burglary Resisting Glazing Material Type

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Shop Drawings; G[, [\_\_\_\_\_]]

## SD-03 Product Data

[Skylights] [ and ] [Translucent Panels]; G[, [\_\_\_\_\_]]

[ Recycled Content for Aluminum Framing Materials; S

] [ Energy Star Label for Residential Skylights; S  
 ] Warranty

SD-06 Test Reports

Test Reports

SD-07 Certificates

Systems

Qualifications

#### 1.4 QUALITY ASSURANCE

- a. Provide documentation of **Qualifications** for the following: The manufacturer is a company specializing in the manufacture of the specified products with a minimum of [5] [10] years documented experience. The installer has documented experience of [5] [\_\_\_\_\_] years minimum performing the work specified.
- b. Before fabrication, provide a full service mock-up of [each type of skylight] [one skylight unit] [\_\_\_\_\_] complete with glass and AAMA certification label for structural purposes and NFRC temporary and Permanent Label for certification of thermal performance rating for review of skylight construction and quality of hardware operation. Glass and glaze in conformance with the applicable requirements of Section **08 81 00 GLAZING**.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Provide factory assembled system modules to the greatest extent possible. Ship panels to the jobsite in rugged shipping units, ready for erection. Affix conspicuous decals on all skylights warning individuals against sitting or stepping on the units. Store skylight panels on the long edge, several **inches** above the ground, blocked and under cover to prevent warping. Deliver unit skylights in manufacturer's original containers, dry, undamaged, with seals and labels intact. Deliver, store and protect all products in accordance with manufacturer's recommendations.

#### 1.6 WARRANTY

Provide the manufacturer's complete warranty for materials, workmanship, and installation. The warranty is for [5] [\_\_\_\_\_] years from the time of project completion and with no proration. The warranty must guarantee, but not be limited to, the following:

- a. [No change in light transmission and color of the panels after exposure to heat of **300 degrees F** for 25 minutes. ] [In accordance with **ASTM D2244**, panels do not darken more than 3.0 Delta E units after 5 years of outdoor weathering in South Florida at 45 degrees facing south. Document compliance with this requirement in submitted Test Reports.]
- b. There is no delamination of the panel affecting appearance, performance, weatherability or structural integrity of the panels or the completed system.



- c. There is no fiberbloom on the panel face.
- d. Change in light transmission of no more than 6 percent in accordance with [ASTM D1003](#), and in color (yellowing index) no more than 10 points in comparison to the original specified value over a 10 year period.
- e. Provide a single source warranty for the glazing panels and the framing system. Third party warranty for the glazing panels will not be accepted.

## PART 2 PRODUCTS

### 2.1 [SKYLIGHTS] [ AND ] [TRANSLUCENT PANELS]

Fabricate skylight panels of [glass-fiber reinforced polyester] [or] [extruded cellular thermoplastic polycarbonate] panels conforming to the specified requirements and other appropriate lab test specified criteria, weighing not less than 8 ounces/square foot. Submit certified [Test Reports](#) from independent testing laboratory for each type and class of panel system. Reports must verify that the material meets specified performance requirements. Previously completed test reports will be acceptable if they are current and indicative of products used on this project. Where a Class A, B or C roof is part of the project, provide a listing certificate for roof covering systems category certifying that the product complies with the safety standards of [ASTM E108](#) and [ICC IBC](#). Size and color of skylight panels as indicated.

### 2.2 GLASS-FIBER PANELS

Provide glass-fiber reinforced polyester panels conforming to [ASTM D3841](#), Class [\_\_\_\_\_] and to the requirements of [AAMA/WDMA/CSA 101/I.S.2/A440](#).

#### 2.2.1 Weatherability

Provide the exposed faces of fiberglass sandwich type panels with a permanent glass veil erosion barrier embedded integrally to provide maximum long term resistance to reinforcing fiber exposure. The exterior face sheet must be uniform in strength and resistant to penetration by pencil point.

#### 2.2.2 Non Combustible Grid Core

Use 6063-T6 aluminum I-beams with provisions for mechanical interlocking of muntin-mullion and perimeter to prevent high and low intersections which do not allow full bonding surface to contact with face material. I-beam width no less than [7/16 inch](#). Machine I-beam grid to tolerances of not greater than plus or minus [0.002 inch](#) for flat panels. Panels must withstand [1200 degrees F](#) fire for a minimum of one hour without collapse or exterior flaming.

#### 2.2.3 Adhesive

Use heat and pressure resin-type laminate adhesive engineered for structural sandwich panel use; which passes testing requirements specified by the International Conference of Building Officials' "Acceptance Criteria for Sandwich Panel Adhesive". Provide with the following minimum strength:

- a. Tensile Strength of [750 psi](#) in accordance with [ASTM C297/C297M](#) after two exposures to six cycles each of the aging conditions prescribed in

ASTM D1037.

- b. Shear Strength, after exposure to five separate aging conditions in accordance with ASTM D1002:
- (1) 540 psi at 50 percent relative humidity and 73 degrees F.
  - (2) 800 psi under accelerated aging in accordance with ASTM D1037 at room temperature.
  - (3) 250 psi under accelerated aging in accordance with ASTM D1037 at 182 degrees F.
  - (4) 1400 psi after 500 hour Oxygen Bomb in accordance with ASTM D572.
  - (5) 100 psi at 182 degrees F.

#### 2.2.4 Panel Construction

Provide panels consisting of fiberglass faces laminated to an aluminum I-beam grid core and deflecting no more than 1.9 inches at 30 psf in 10 feet in accordance with ASTM E72, without a supporting frame. Include manufacturing facilities, sandwich panel components and production sandwich panels in the quality control inspections and required testing, conducted at least once each year, for conformance with ICC-ES AC04 or equivalent. [Provide aluminum framing materials with a minimum recycled content of 20 percent. Provide data identifying percentage of recycled content for aluminum framing materials.]

#### 2.3 THERMOPLASTIC POLYCARBONATE PANELS

Manufacture systems from translucent polycarbonate panels designed for architectural applications. Provide panels consisting of a polycarbonate resin with a permanent, co-extruded, ultra-violet protective layer; co-extruded by the manufacturer during the original extrusion of the panel a permanent part of the exterior and interior layers. Pot-applied coatings or films of dissimilar materials are unacceptable. Provide panel width not to exceed 2 feet to ensure best performance for wind uplift, vibration, oil canning and visual appearance. Meet the following manufacturing requirements:

- a. Extruded in one single formable length. Transverse sections are unacceptable. Manufacture the panels with upstands which are integral to the unit, and with the upstands 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seam is unacceptable.
- b. Provide dry glazed profiles mullions, using no sealant, welding, adhesives or gaskets; thermally break mullions continuous for panel length.
- c. For structural performance, the use of adhesives, plastic or sonic welding or sealant is not allowed.
- d. For longevity, the minimum ratio of panel weight to thickness must be [ 0.5 psf for 0.4 inch] [ 0.68 psf for 0.63 inch] [ 0.91 psf for 2.2, 3, and 4 inch double glazed] thick panel.
- e. Extruded panel includes integral extruded multi-cells, and truss-like

structural core for resistance to buckling. Interconnect the panel's exterior skins and space apart by supporting ribs, perpendicular to the skins, at a spacing not to exceed 0.16 inches (truss-like construction). In addition, divide the space between the two exterior skins in a cross section by multiple parallel intermediate surfaces, at a spacing not to exceed 0.16 inches.

- f. Interior flame spread classification is Class [I] [II] in accordance with ASTM E84.
- g. Smoke density no greater than 70 in accordance with ASTM D2843.
- h. The exterior and interior faces must be an approved light transmitting panel with a CC1 fire rating classification in accordance with ASTM D635.
- i. Self-ignition greater than 1058 degrees F in accordance with ASTM D1929.
- j. Fire rated roof assembly translucent panels must be successfully evaluated for fire from exterior exposure in accordance with [ASTM E108] [\_\_\_\_\_] to meet Class [A] [B] [C] rating. Provide panel listed by an independent recognized listing laboratory.

## 2.4 COMMON PANEL REQUIREMENTS

### 2.4.1 Appearance

Provide face sheets uniform in color to prevent splotchy appearance and completely free of ridges and wrinkles which prevent proper surface contact. Clusters of air bubbles/pinholes which collect moisture and dirt are not acceptable.

### 2.4.2 Panel Fabrication

Panel construction must meet the following requirements:

- a. Light transmission [\_\_\_\_\_] percent; color [\_\_\_\_\_].
- b. Assembled panel thickness [\_\_\_\_\_] inches.
- c. Grid size [\_\_\_\_\_] [as indicated].

### 2.4.3 Thermal Performance

Provide non-residential skylights (including frames and glass) certified by the National Fenestration Rating Council with a whole-unit Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] determined according to NFRC 200 procedures and a U-factor maximum of [\_\_\_\_\_] Btu/hr-ft<sup>2</sup>-F in accordance with NFRC 100.

Provide residential skylights (including frames and glass) that are Energy Star labeled products for the [Northern] [North-Central] [South-Central] [Southern] climate zone, or have the following performance characteristics: [Southern climate zone, thermal properties of windows must not exceed a U-factor of 0.60 determined according to NFRC 100, and a solar heat gain coefficient (SHGC) not exceeding 0.28 determined according to NFRC 200.] [South-Central climate zone, thermal properties of windows must not exceed a U-factor of 0.53 determined according to NFRC 100, and a solar heat gain coefficient (SHGC) not exceeding 0.28 determined according to NFRC 200.] [North-Central climate zone, thermal properties of windows must not exceed a

U-factor of 0.53 determined according to NFRC 100, and a solar heat gain coefficient (SHGC) not exceeding 0.35 determined according to NFRC 200.] [ Northern climate zone, thermal properties of windows must not exceed a U-factor of 0.50 determined according to NFRC 100.] [ Provide proof of Energy Star label for residential skylights.]

#### 2.4.4 Condensation Index Rating

The condensation index rating must be [\_\_\_\_\_] as determined using National Fenestration Rating Council approved software THERM.

#### 2.5 [SKYLIGHT] [ AND ] [TRANSLUCENT PANEL] SYSTEMS

Submit manufacturer's certificate that the systems meet or exceed specified requirements. Provide systems evaluated and listed (the whole [skylight] [ and ] [translucent panel] as a unit, not just a glazing material in the unit) by the recognized building code authorities: ICC and SBCCI-Public Safety Testing and Evaluation Services Inc. Product ratings determined using NFRC 100 and NFRC 200 must be authorized for certification and properly labeled by the manufacturer. Provide [skylight] [ and ] [translucent panel] systems meeting the following requirements:

- a. Integral perimeter framing system assembly by the manufacturer.
- b. Exterior panel faces [crystal] [clear matte] [white] [\_\_\_\_\_] in color. Interior panel faces [crystal] [clear matte] [white] [\_\_\_\_\_] in color.
- c. Air infiltration at 1.57 psf less than [0.04] [\_\_\_\_\_] cfm/ft<sup>2</sup> and at 6.24 psf less than [0.07] [0.1] [\_\_\_\_\_] cfm/ft<sup>2</sup> in accordance with ASTM E283.
- d. Water penetration at test pressure of 15 psf equals zero in accordance with ASTM E331.
- e. Manufacturer is responsible for maximum system deflection, in accordance with the applicable building code, and without damage to system performance. Calculate deflection in accordance with engineering principles.
- f. Incorporate weepage elements within the perimeter framework of the glazing system for drainage of any condensation or water penetration.
- g. System must accommodate movement within the system; movement between the system and perimeter framing components; dynamic loading and release of loads; and deflection of supporting members. Achieve this without damage to system or components, deterioration of weather seals and fenestration properties specified.
- h. The exterior panel face must repel an impact of [ 50 foot-pounds without fracture or tear when impacted by a 3.25 inch diameter, 5 pound free falling ball dropped from a vertical distance of 10 feet] [ 200 foot-pounds without fracture or tear when impacted by a 3.25 inch diameter, 5 pound free falling ball dropped from a vertical distance of 40 feet] when tested in accordance with UL 972.
- i. Provide system meeting the fall through requirements of 29 CFR 1910.23 as demonstrated by testing in accordance with ASTM E661 or ASTM E695, thereby not requiring supplemental screens or railings.
- j. Exposed aluminum color must be [a [\_\_\_\_\_] shade] selected from the

manufacturer's standard range. Provide corrosion resistant [baked-on enamel coating in accordance with AAMA 2603 with a total dry film thickness not less than 0.8 mil] [superior-performance organic finish in accordance with AAMA 2605] [with total dry film thickness of not less than 1.2 mils] [anodized finish complying with AA DAF45 and AAMA 611 must be [Architectural Class II (0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color]] [Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.]].

- k. Provide a system requiring no scheduled recoating to maintain its performance or for UV resistance.
- l. Design criteria:
  - (1) Wind Load [\_\_\_\_]; snow load [\_\_\_\_].
  - (2) Frame Blast Loads: Design framing to resist 50 pounds per square foot blast load at L/160 deflection.
  - (3) Anchor Blast Loads: Design anchors to resist 100 pounds per square foot blast load.
- m. Use 6063-T6 and 6063-T5 extruded aluminum; all fasteners of stainless steel or plated steel.

#### 2.5.1 Glass Glazed Skylights and Roof Windows

Provide roof windows to withstand dead and live loads caused by pressure and uplift of wind acting normal to the plane of roof and tested by an ICC listed, independent testing and quality control inspection agency to an allowable downward pressure of [12-182] [\_\_\_\_] psf and an uplift pressure of [22-105] [\_\_\_\_] psf measured in accordance with ASTM E330/E330M, as recommended by the manufacturer for the type of window tested.

##### 2.5.1.1 Fixed Skylight

Fixed skylight featuring a select wood frame, mortise and tenon joints, gaskets to drain any condensation to the outside, a choice of tempered clear, laminated, insulated daylight area. Provide [aluminum] [copper] protective exterior cladding for protection and low profile appearance. The skylight must have a [ventilation flap] that opens to allow air circulation and contains a filter within the flap to keep dust and insects out] [ventilating panel and insect screen with an operator hook that allows easy opening and closing, with control rods, for out-of-reach installations or smooth-turning handle for within-reach installation].

##### 2.5.1.2 Emergency Escape and Rescue Roof Window

Emergency escape and rescue roof window which opens [45] [\_\_\_\_] degrees to satisfy egress requirements for emergency escape. When the unit is closed, a ventilation flap can be opened to allow in fresh air. For easy cleaning from inside the room, the sash rotates completely inward. Insect screen and sunscreen accessories are available.

##### 2.5.1.3 Balcony Roof Window Featuring Dual-Sash Operation

The top sash opens for maximum ventilation and also pivots completely

inward for easy cleaning from inside the room; the bottom sash opens outward to create a roof balcony. When the window is closed, a ventilation flap allows fresh air circulation. Insect screen and sunscreen accessories are available.

## 2.5.2 [Plastic Glazed Unit Skylight] [ and ] [Translucent Panels]

### 2.5.2.1 Dome

Provide factory assembled dome skylight units each consisting of [a single dome or sealed double domes with a 0.06 inch extruded aluminum frame and 0.06 inch] [sealed double or triple domes with 0.06 inch extruded aluminum frame with a polyurethane thermal break to prevent condensation on the interior portion of the frame and 0.07 inch] extruded aluminum retainer cap. Submit Manufacturer's descriptive data, catalog cuts and certificate stating that products meet or exceed specified requirements. Provide the skylight with an integral condensation gutter with weep hole slots to provide sufficient drainage to the outside; and [clear] [white] [bronze] [\_\_\_\_\_] dome. Use the manufacturer's standard for self-flashing domes, the curbs, treated wood nailer, and insulation. Uniform design load capacity of composite dome and frame must meet or exceed [40] [30] [\_\_\_\_\_] psf snow load. Insulated curbs with PVC thermal barriers connecting the top and bottom of the inner and outer walls are available.

### 2.5.2.2 Pyramid

Pyramid skylights are, for all practical purposes, just a configuration alternative to the dome skylights; the requirements specified above for the domes also apply to the pyramids. Pyramid skylight units are available from 4 to 20 foot square and can be used for both self-flashing or curb mount installations; 22 and 40 degrees are standard. The maximum horizontal thrust load on the pyramid curb is [ 90 to 330 lbs (1 panel per side)] [ 410 to 730 lbs (2 panels per side)] [ 850 to 1300 lbs (4 panels per side)] depending on size. Pyramids are available in grid and tandem models.

### 2.5.2.3 Vault

Provide [single] [double] glazed vault skylights; barrel vault height, for low rise vaults, at 10 percent of the vault width, and 50 percent of the vault width for half round vaults; provide outside curbs in accordance with the manufacturer's details. Vaults must support a 30 or 40 psf roof snow or live load, and a negative 25 psf wind load plus dead load; rafter spacing is determined by load requirements but must not exceed 36 inches on center for 40 psf and 48 inches on center for 30 psf. Provide sill members that are factory slotted at anchors for thermal movement, and weep water infiltration and condensation. Use EPDM gaskets. Ship all units over 87 inches unassembled for access to anchors from roof level.

## 2.5.3 [Framed Skylights] [ and] [Translucent Panels]

Framed skylights must [be designed to [\_\_\_\_\_] size] [span up to [12] [\_\_\_\_\_] feet in a single pitch and up to [20] [\_\_\_\_\_] feet in a double pitch configuration]; determine rafter and purlin spacing by loading requirements. Skylights manufactured in prefabricated sections easy to install are available in a wide range of standardized pitches. Provide [tubular] [I-beam] framing members; deflection of rafters not to exceed [L/175] [L/180] [\_\_\_\_\_] of the rafter span. A registered professional engineer must size all framing members and design all structural connections; submit a copy of the calculations. Framing includes a primary

gutter system with secondary gutters to control water infiltration and condensation runoff from the underside of the glazing material and channel it to the exterior. Design skylight structural members for a live load of [\_\_\_\_\_] psf and wind load of [\_\_\_\_\_] psf; do not induce objectionable distortion or stress in fastenings and joinery due to expansion and contraction when subjected to a 100 degree F temperature change.

## 2.6 FLEXIBLE SEALING TAPE

Provide manufacturer's standard pre-applied sealing tape to closure system at the factory under controlled conditions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Field verify all submitted opening sizes, dimensions and tolerances; preparation of openings includes isolating dissimilar materials from aluminum system to avoid damage by electrolysis. The installer must examine area of installation to verify readiness of site conditions and to notify the Contractor about any defects requiring correction. Verify when structural support is ready to receive all specified work and to convene a pre-installation conference, if approved by the Contracting Officer, including the Contractor, skylight installer and all parties directly affecting and affected by the specified work. Do not install any materials that show visual evidence of biological growth due to the presence of moisture. Do not commence work until conditions are satisfactory.

### 3.2 ERECTION

Erect translucent skylight system in accordance with the approved shop drawings supplied by the manufacturer. Submit drawings showing fabrication details, materials, dimensions, installation methods, anchors, and relationship to adjacent construction. Fasten and seal in accordance with the manufacturer's shop drawings. Remove all panel, after other trades have completed work on adjacent materials. Carefully inspect and adjust panel installation as necessary to ensure proper installation and weather-tight conditions. provide all staging, lifts and hoists required for the complete installation and field measuring. Install system clean of dirt, debris or staining and thoroughly examined for removal of all protective material prior to final inspection of the designated work area. Do not use snow rakes on roof windows or skylights.

-- End of Section --

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## SECTION 08 71 00

DOOR HARDWARE  
02/16, CHG 4: 02/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

- ASTM E283 (2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- ASTM F883 (2013; R 2022) Standard Performance Specification for Padlocks

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

- ANSI/BHMA A156.1 (2021) Butts and Hinges
- ANSI/BHMA A156.2 (2017) Bored and Preassembled Locks and Latches
- ANSI/BHMA A156.3 (2020) Exit Devices
- ANSI/BHMA A156.4 (2013) Door Controls - Closers
- ANSI/BHMA A156.5 (2020) Cylinder and Input Devices for Locks
- ANSI/BHMA A156.6 (2021) Architectural Door Trim
- ANSI/BHMA A156.7 (2016) Template Hinge Dimensions
- ANSI/BHMA A156.8 (2021) Door Controls - Overhead Stops and Holders
- ANSI/BHMA A156.10 (2017) Power Operated Pedestrian Doors
- ANSI/BHMA A156.12 (2013) Interconnected Locks & Latches
- ANSI/BHMA A156.13 (2017) Mortise Locks & Latches Series 1000
- ANSI/BHMA A156.14 (2013) Sliding and Folding Door Hardware
- ANSI/BHMA A156.15 (2021) Release Devices Closer Holder, Electromagnetic and Electromechanical
- ANSI/BHMA A156.16 (2018) Auxiliary Hardware
- ANSI/BHMA A156.17 (2019) Self Closing Hinges & Pivots

ANSI/BHMA A156.18	(2020) Materials and Finishes
ANSI/BHMA A156.19	(2013) Power Assist & Low Energy Power Operated Doors
ANSI/BHMA A156.21	(2019) Thresholds
ANSI/BHMA A156.22	(2021) Gasketing
ANSI/BHMA A156.23	(2010) Electromagnetic Locks
ANSI/BHMA A156.24	(2012) Delayed Egress Locking Systems
ANSI/BHMA A156.25	(2013) Electrified Locking Devices
ANSI/BHMA A156.26	(2012) Continuous Hinges
ANSI/BHMA A156.27	(2011) Power and Manual Operated Revolving Pedestrian Doors
ANSI/BHMA A156.29	(2012) Exit Locks, Exit Alarms, Alarms for Exit Devices
ANSI/BHMA A156.30	(2014) High Security Cylinders
ANSI/BHMA A156.31	(2013) Electric Strikes and Frame Mounted Actuators
ANSI/BHMA A156.36	(2010) Auxiliary Locks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
NFPA 72	(2022) National Fire Alarm and Signaling Code
NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8	(2017) Specifications for Standard Steel Doors and Frames
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA)  
Accessibility Guidelines for Buildings and  
Facilities; Architectural Barriers Act  
(ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL 14C (2006; Reprint Oct 2021) UL Standard for  
Safety Swinging Hardware for Standard  
Tin-Clad Fire Doors Mounted Singly and in  
Pairs

UL Bld Mat Dir (updated continuously online) Building  
Materials Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Manufacturer's Detail Drawings; G[, [\_\_\_\_]]

Verification of Existing Conditions; G[, [\_\_\_\_]]

Hardware Schedule; G[, [\_\_\_\_]]

Keying System; G[, [\_\_\_\_]]

### SD-03 Product Data

Hardware Items; G[, [\_\_\_\_]]

### SD-08 Manufacturer's Instructions

Installation

### SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1; G[, [\_\_\_\_]]

### SD-11 Closeout Submittals

Key Bitting

## 1.3 SHOP DRAWINGS

Submit manufacturer's detail drawings indicating all hardware assembly components and interface with adjacent construction. [ Indicate power components and wiring coordination for electrified hardware.] Base shop drawings on verified field measurements and include verification of existing conditions.

## 1.4 PRODUCT DATA

Indicate fire-ratings at applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by 36 CFR 1191 Appendix D - Technical.

#### 1.5 HARDWARE SCHEDULE

Provide Hardware Item List and Hardware Schedule containing the following information, and additional information as needed to identify the complete make up of each hardware set and its application to each opening:

##### 1.5.1 Hardware Item List:

- a. Hardware Type
- b. Item Number
- c. Quantity
- d. Size(s)
- e. Reference Publication / Type Number
- f. Manufacturer's Name / Catalog Number
- g. Key Control Symbols
- h. UL Mark (If fire rated and listed)
- i. BHMA Finish(es)
- j. Remarks

##### 1.5.2 Hardware Schedule

- a. Hardware Set Number
- b. Opening Number(s)
- c. Opening Description (single/double leaf, hand, size, door/frame material)
- d. Fire Rating
- e. Sound Rating
- f. Hardware Items
- g. Quantity
- h. Size
- i. BHMA Finish
- j. Remarks

In addition, submit hardware schedule data package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

## 1.6 KEY BITTING CHART REQUIREMENTS

### 1.6.1 Requirements

Submit [key bitting](#) charts to the Contracting Officer prior to completion of the work. Include:

- a. Complete listing of all keys (e.g. AA1 and AA2).
- b. Complete listing of all key cuts (AA1-123456, AA2-123458).
- c. Tabulation showing which key fits which door.
- d. Copy of floor plan showing doors and door numbers.
- e. Listing of 20 percent more key cuts than are presently required in each master system.

## 1.7 QUALITY ASSURANCE

### 1.7.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, [ pivots,] and closers of one lock, hinge, [ pivot,] or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

### 1.7.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware Subcontractor, using Activity and Base Locksmith must meet to discuss and coordinate key requirements for the facility.

## 1.8 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown on hardware schedule. [ Deliver permanent keys [ and removable cores] to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.]

## PART 2 PRODUCTS

### 2.1 TEMPLATE HARDWARE

Hardware applied to metal [or to prefinished ]doors must be manufactured using a template. Provide templates to door and frame manufacturers in accordance with [ANSI/BHMA A156.7](#) for template hinges. Coordinate hardware items to prevent interference with other hardware.

### 2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of [NFPA 72](#) for door alarms, [NFPA 80](#) for fire doors, [NFPA 101](#) for exit doors, [NFPA 252](#) for fire tests of door assemblies, ABA/ADA accessibility requirements, and all other requirements indicated, even if such hardware is not specifically mentioned in paragraph HARDWARE SCHEDULE. [ Provide swinging hardware for tin-clad fire doors in accordance with [UL 14C](#).] Provide Underwriters

Laboratories, Inc. labels for such hardware in accordance with [UL Bld Mat Dir](#) or equivalent labels in accordance with another testing laboratory approved in writing by the Contracting Officer.

### 2.3 [HARDWARE ITEMS](#)

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark is visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover. Coordinate electrified door hardware components with corresponding components specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

#### 2.3.1 Hinges

Provide in accordance with [ANSI/BHMA A156.1](#). Provide hinges that are [4-1/2 by 4-1/2 inch](#) unless otherwise indicated. Construct loose pin hinges for interior doors and reverse-bevel exterior doors so that pins are non-removable when door is closed. Other anti-friction bearing hinges may be provided in lieu of ball bearing hinges.

##### [2.3.1.1 Protection Devices

Provide full height hand and finger protection device at the hinge-side area opening of doors and gates. Provide hinge-side protection devices on both sides of doors and gates, covering hinges and space between door and frame when doors are in the open position. The installed device must push hand and fingers out of the opening and away from a crushing hazard.

##### ]2.3.2 Continuous Hinges

Where continuous hinges are required, provide in accordance with [ANSI/BHMA A156.26](#).

#### 2.3.3 Pivots

Provide in accordance with [ANSI/BHMA A156.17](#).

#### 2.3.4 Spring Hinges

Provide in accordance with [ANSI/BHMA A156.17](#).

#### 2.3.5 Locks and Latches

- [ a. At exterior locations provide locksets of full stainless steel type 302 or 304 construction including fronts, strike, escutcheons, knobs, bolts and all interior working parts. Marine Grade I, fully non-ferrous.
- b. In non-air-conditioned interior environments or humid interior environments, provide interior locksets on the same Marine Grade I, fully non-ferrous as exterior locksets.

##### ]2.3.5.1 Mortise Locks and Latches

Provide in accordance with [ANSI/BHMA A156.13](#), Series 1000, Operational Grade 1, Security Grade 2.[ Provide factory installed lead lining in locks for lead shielded doors.][ Provide mortise locks with escutcheons not less than [7 by 2-1/4 inch](#) with a bushing at least [1/4 inch](#) long. Cut escutcheons to fit cylinders and provide trim items with straight, beveled,

or smoothly rounded sides, corners, and edges.] Provide knobs and roses of mortise locks with screwless shanks and no exposed screws.

#### 2.3.5.2 Bored Locks and Latches

Provide in accordance with ANSI/BHMA A156.2, Series 4000, Grade 1.[ Provide factory installed lead lining in locks for lead -shielded doors.]

#### 2.3.5.3 Residential Bored Locks and Latches

Provide in accordance with ANSI/BHMA A156.2, Series 4000, Grade 2. Install locks for exterior doors with threaded roses or concealed machine screws.

#### [2.3.5.4 Interconnected Locks and Latches

Provide in accordance with ANSI/BHMA A156.12. Provide F96 or F97, unless otherwise specified.

#### ]2.3.5.5 Hospital Latches

Push-pull latch set similar and equal to Glynn-Johnson HL6, 1/2 inch throw, [2-3/4 inch] [5 inch] backset, to fit 161 cutout. Cover approximately 2-1/2 by 5-1/2 inch, handle approximately 1-1/2 by 4-1/2 inch, projection approximately 2-1/2 inch, covers and handles of stainless steel, BHMA 630 finish, engraved "PUSH" and "PULL" on handles, push handle pointing up, pull handle pointing down.

#### 2.3.5.6 Auxiliary Locks

Provide in accordance with ANSI/BHMA A156.36, Grade 1.

#### 2.3.5.7 Combination Locks

[Key pharmacy door locks separately from building master key system. ]Heavy-duty, mechanical combination lockset with five push buttons, standard sized knobs, 3/4 inch deadlocking latch, 2-3/4 inch backset. Locks to operate by pressing two or more of the buttons in unison or individually in the proper sequence. Inside knob operates the latch. Provide a keyed cylinder on the interior to permit setting the combination.[ Provide a keyed [removable core ]cylinder on the exterior to permit bypassing the combination.][ Provide a thumb turn on the interior to activate passage set function so that outside knob operates latch without using the combination.]

#### 2.3.6 Exit Devices

Provide in accordance with ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide [touch bars in lieu of conventional crossbars and arms.][ Provide escutcheons not less than 7 by 2-1/4 inch.]

[ Use stainless steel or bronze base metal with plated finishes. Also include stainless steel fasteners and screws.

#### ]2.3.7 Exit Locks With Alarm

Provide in accordance with ANSI/BHMA A156.3 and ANSI/BHMA A156.29, Type E0431 (with full width horizontal actuating bar) for single doors; Type

E0431 (with actuating bar) or E0471 (with actuating bar and top and bottom bolts, both leaves active) for pairs of doors, unless otherwise specified. [ Provide terminals for connection to remote indicating panel. ] [ Provide outside control key. ] Provide door alarms integrated with the fire alarm system in accordance with [NFPA 72](#).

### 2.3.8 Cylinders and Cores

[Provide cylinders and cores for new locks, including locks provided under other sections of this specification. ] Provide cylinders and cores with [six] [seven] pin tumblers. Provide cylinders from the products of one manufacturer, and provide cores from the products of one manufacturer. [ Rim cylinders, mortise cylinders, and knobs of bored locksets have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core. ]

[ Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders of Grade 1 products from products of one manufacturer with interchangeable cores that are removable by a special control key. Factory set the cores with [six] [seven] pin tumblers using the A4 system and F keyway. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

] [For medical projects, key pharmacy door locks separately from building master key system.

#### ] 2.3.8.1 High Security Cylinders

Provide in accordance with [ANSI/BHMA A156.30](#), security level [A] [B] [C] for all high security cylinder components.

### 2.3.9 Push Button Mechanisms

Provide in accordance with [ANSI/BHMA A156.5](#), Grade 1.

### 2.3.10 Electrified Hardware

Comply with the requirements of [NFPA 70](#) for wiring of electrified hardware.

#### 2.3.10.1 Electric Strikes and Frame Mounted Actuators

Provide in accordance with [ANSI/BHMA A156.31](#), Grade 1. Provide electric strikes and actuators as required to meet operational requirements. Provide electric strikes that [release automatically] [remain secure] [remain maintained] during power failure. [ Provide a separate power supply for electric strikes, other locking devices and ancillary parts. ] [ Provide battery backup for continued operation during power failure. ] Provide strikes and actuators with a minimum opening force of [2300 pounds](#).

Provide facility interface devices that use direct current (dc) power to energize the solenoids. Provide electric strikes and actuators that incorporate end-of-line resistors to facilitate line supervision by the system. If not incorporated into the electric strike or local controller, provide metal oxide resistors (MOVs) to protect the controller from reverse current surges.

##### 2.3.10.1.1 Solenoid



Provide actuating solenoid for strikes and actuators that are rated for continuous duty, cannot dissipate more than 12 Watts and must operate on 12 or 24 Volts dc. Inrush current cannot exceed 1 ampere and the holding current cannot be greater than 500 milliamperes. Actuating solenoid must move from fully secure to fully open positions in less than 500 milliseconds.

#### 2.3.10.1.2 Signal Switches

Provide strikes and actuators with signal switches to indicate to the system when the bolt is not engaged or the strike mechanism is unlocked. Signal switches must report a forced entry to the system.

#### 2.3.10.1.3 Tamper Resistance

[ Provide strike guards that prevent tampering with the latch bolt of the locking hardware or the latch bolt keeper of the electric strike. Strike guards to bolt through the door using tamper resistant screws. Provide strike guards made of 1/8 inch thick brass and that are 11-1/14 inch high by 1-5/8 inch wide, with a minimum 5/32 inch wide offset.

#### ]2.3.10.1.4 Coordination

Provide electric strikes and actuators of a size, weight and profile compatible with each specified door frame. Field verify installation clearances prior to procurement.

#### 2.3.10.1.5 Mounting Method

Provide electric strikes and actuators suitable for use with single and double doors, with mortise or rim type hardware specified, and for right or left hand mounting as specified. In double door installations, locate the lock in the active leaf and monitor the fixed leaf.

#### 2.3.10.2 Electrified Mortise Locks

Provide in accordance with ANSI/BHMA A156.25, Grade 1. Provide electrified mortise locks that [release automatically] [remain secure] [remain maintained] during power failure. Provide facility interface devices that use dc power to energize solenoids. Provide solenoids, resistors, and signal switches in accordance with paragraph ELECTRIC STRIKES AND FRAME MOUNTED ACTUATORS.

#### 2.3.10.2.1 Power Transfer Hinges

Provide power transfer hinges with each electrified lock that route power and monitoring signals from the lockset to the door frame. Coordinate power transfer hinges with door frames.

#### 2.3.10.3 Card Readers and Keypad Access Control Hardware

Provide in accordance with ANSI/BHMA A156.5 and ANSI/BHMA A156.25, Grade 1 components. Provide devices that are tamper alarmed, tamper and vandal resistant, solid state, and do not contain electronics which could compromise the access control subsystem should the subsystem be attacked. Provide surface, semi-flush, pedestal, or weatherproof mountable devices as specified for each individual location. [ Each device to contain a visual display, either mounted on the face, or on an integral part of the device,

to indicate access or exit request processing, request approval, and request denial.] Provide [proximity] [insertion] [swipe through] type card readers capable of reading [magnetic stripe] [high coercivity magnetic stripe] [Wiegand] [Hollerith] [proximity] [Transmissive Infrared] [Keypad] [[\_\_\_\_\_] /Keypad] [Smart Card] [Biometric] [\_\_\_\_\_] type access control cards. Provide keypads that contain an integral 12-digit tactile keyboard with digits [arranged in numerical order]. Provide keypads that are [a standalone device] [or] [integrated into the card reader]. Coordinate access control hardware with corresponding devices and systems specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

#### 2.3.10.4 Power Operated Pedestrian Door Hardware

Provide in accordance with [ANSI/BHMA A156.10](#), Grade 1.

#### 2.3.10.5 Release Devices

In accordance with [ANSI/BHMA A156.15](#), Grade 1.

##### 2.3.10.5.1 Closer Holders

Provide [floor] [door] [header] mounted closer holder devices connected by [separate releasing] [integral releasing] to [fire] [smoke] detecting devices.

##### 2.3.10.5.2 Release Devices

Provide [wall] [floor] [door] mounted [Electromagnetic] [electromechanical] [free swinging] release devices connected to [fire] [smoke] detecting devices.

#### 2.3.10.6 Power Assist and Low Energy Power Operated Doors

Provide in accordance with [ANSI/BHMA A156.19](#), Grade 1.

#### 2.3.10.7 Electromagnetic Locks

Provide in accordance with [ANSI/BHMA A156.23](#), Grade 1. Provide electromagnetic locks that do not contain any moving parts and depend solely upon electromagnetism to secure a portal by generating at least **1200 pounds** of holding force. The lock must interface with the local processors without external, internal or functional alteration of the local processor. The electromagnetic lock must incorporate an end of line resistor to facilitate line supervision by the system. Provide metal-oxide resistors (MOVs) to protect controllers from reverse current surges, if not incorporated into the electromagnetic lock or local controller.

##### 2.3.10.7.1 Armature

Provide electromagnetic locks with internal circuitry to eliminate residual magnetism and inductive kickback. Provide actuating armature that operates on 12 or 24 Volts dc and cannot dissipate more than 12 Watts. Holding current must be less than 500 milliamperes. Actuating armature must take less than 300 milliseconds to change the status of the lock from fully secure to fully open or fully open to fully secure.

##### 2.3.10.7.2 Tamper Resistance

Provide lock mechanism encased in hardened guard barriers to deter forced

entry.

#### 2.3.10.7.3 Mounting Method

Provide electromagnetic lock suitable for use with single and double door with mortise or rim type hardware and compatible with right or left hand mounting.

#### 2.3.10.8 Delayed Egress Locking System

Provide in accordance with ANSI/BHMA A156.24, Grade 1.

#### 2.3.10.9 Power and Manual Operated Revolving Pedestrian Doors

Provide in accordance with ANSI/BHMA A156.27, Grade 1.

#### 2.3.11 Keying System

Provide [ a [great] [grand] master keying system] [ an extension of the existing keying system. Existing locks were manufactured by [\_\_\_\_\_] and [do not] have interchangeable cores.] [ Provide [ a construction master keying system] [ construction interchangeable cores].] [ Provide key cabinet as specified.]

[The Government will provide permanent cylinders with cores and keys for mortise locksets, auxiliary locks, and exit devices. ] [Provide cylinders of Grade 1 products from one manufacturer. Notify the Contracting Officer 90 days prior to the required delivery of the cylinders. Provide temporary cores and keys for the Contractor's use during construction, and for testing of locksets.]

#### 2.3.12 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

##### 2.3.12.1 Knobs and Roses

Provide in accordance with ANSI/BHMA A156.2 and ANSI/BHMA A156.13 for knobs, roses, and escutcheons. For unreinforced knobs, roses, and escutcheons, provide a 0.050 inch thickness. For reinforced knobs, roses, and escutcheons, provide an outer shell thickness of 0.035 inch and a combined total thickness of 0.070 inch, except at knob shanks. Provide knob shanks 0.060 inch thick.

##### 2.3.12.2 Lever Handles

Provide lever handles [where indicated in the Hardware Schedule]. Provide in accordance with ANSI/BHMA A156.3 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

##### 2.3.13 Keys

[Furnish] [Provide] one file key, one duplicate key, and one working key for each key change [and for each master [and grand master] keying system].

[Furnish][Provide] one additional working key for each lock of each keyed-alike group. [ [Furnish][Provide] two additional keys for each sleeping room.] [ [Furnish][Provide] [[\_\_\_\_\_] great grand master keys,] [[\_\_\_\_\_] construction master keys,] [and [\_\_\_\_\_] control keys for removable cores].] [ [Furnish][Provide] a quantity of key blanks equal to 20 percent of the total number of file keys.] Stamp each key with appropriate key control symbol and "U.S. property - do not duplicate." Do not place room number on keys.

[ [Furnish][Provide] seven change keys for each interchangeable core, [furnish][provide] two control keys, six masters keys, and six construction master keys. [ [Furnish][Provide] a quantity of key blanks equal to 20 percent of the total number of change keys.] Stamp each key with appropriate key control symbol and "U.S. property - do not duplicate." Do not place room numbers on keys.

#### ]2.3.14 Door Bolts

Provide in accordance with [ANSI/BHMA A156.16](#). Provide dustproof strikes for bottom bolts, except at doors having metal thresholds. Provide automatic latching flush bolts in accordance with [ANSI/BHMA A156.3](#), Type 25.

#### 2.3.15 Closers

Provide in accordance with [ANSI/BHMA A156.4](#), Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, [full size covers, except at storefront mounting,] [pivots,] [cement cases,] and other features necessary for the particular application. Size closers in accordance with manufacturer's printed recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

[ Use stainless steel inside bracketed or door mounted closers on exterior doors. Non-ferrous closers, such as aluminum or cast bronze, are permissible where door utilization is minimal. On interior doors use closers of 302 or 304 stainless steel or non-ferrous materials. On surface-mounted closers use or apply rust inhibiting finish on all ferrous parts. Also apply this finish on concealed closers.

#### ]2.3.15.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation in locations that will be visible after installation.

#### 2.3.16 Overhead Holders

Provide in accordance with [ANSI/BHMA A156.8](#).

#### 2.3.17 Door Protection Plates

Provide in accordance with [ANSI/BHMA A156.6](#).

#### 2.3.17.1 Sizes of [Armor] [Mop] [and] Kick Plates

2 inch less than door width for single doors; 1 inch less than door width for pairs of doors. Provide [[8] [10] inch kick plates for flush doors] [and] [1 inch less than height of bottom rail for panel doors]. Provide a minimum [36] [48] [\_\_\_\_\_] inch armor plates for flush doors [and]

completely cover lower panels of panel doors, except 16 inch high armor plates on fire doors. Provide [4] [6] inch mop plates.

#### 2.3.17.2 Edge Guards

Stainless steel, of same height as armor plates. Apply to [hinge stile] [lock stile] [meeting stiles].

#### 2.3.18 Door Stops and Silencers

Provide in accordance with ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

#### 2.3.19 Padlocks

Provide in accordance with ASTM F883.

#### 2.3.20 Thresholds

Provide in accordance with ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

#### 2.3.21 Weatherstripping Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph HARDWARE SCHEDULE. Provide a set to include head and jamb seals[, sweep strips,] [and, for pairs of doors, astragals]. Air leakage of weatherstripped doors not to exceed [0.5] [1.25] cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283. Provide weatherstripping with one of the following:

##### 2.3.21.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide [clear (natural)] [bronze] anodized aluminum.

##### 2.3.21.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

##### 2.3.21.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

#### 2.3.22 [Lightproofing] [and] [Soundproofing] Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide adjustable doorstops at heads, jams and automatic door bottoms in accordance with the hardware set, of extruded aluminum, [clear (natural)] [bronze] anodized, surface applied, with vinyl fin seals between plunger and housing. Provide doorstops with solid neoprene tube, silicone rubber, or closed cell sponge gasket. Provide door bottoms with adjustable operating rod and silicone rubber or closed cell sponge neoprene gasket. Provide doorstops that are mitered at corners. Provide type and function designation where specified in paragraph HARDWARE SETS.

### 2.3.23 Rain Drips

Provide in accordance with ANSI/BHMA A156.22. Provide extruded aluminum rain drips, not less than 0.08 inch thick, [clear anodized] [bronze anodized] [factory painted] [factory primed] finish. Provide the manufacturer's full range of color choices to the Contracting Officer for color selection. [ Provide rain drips with a 4 inch overlap on each side of each exterior door that is not protected by an awning, roof, eave or other horizontal projection.] Set drips in sealant and fasten with stainless steel screws.

#### 2.3.23.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

#### 2.3.23.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection. Align bottom with door frame rabbet.

### 2.3.24 Auxiliary Hardware (Other than locks)

Provide in accordance with ANSI/BHMA A156.16, Grade 1.

### 2.3.25 Sliding and Folding Door Hardware

Provide in accordance with ANSI/BHMA A156.14, Grade 1. Finishes to match other hardware specified herein.

### 2.3.26 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, as required to service and adjust hardware items.

## 2.4 FASTENERS

Provide fasteners of type, quality, size, and quantity appropriate to the specific application. Fastener finish to match hardware. Provide stainless steel or nonferrous metal fasteners in locations exposed to weather. Verify metals in contact with one another are compatible and will avoid galvanic corrosion when exposed to weather.

## 2.5 FINISHES

[ Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except [aluminum paint] [prime coat] finish for surface door closers, and except [BHMA 652 finish (satin chromium plated)] [BHMA 600 finish (primed for painting)] for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish [ or chromium plated brass or bronze with BHMA 626 finish]. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish [except where BHMA 630 is specified under paragraph HARDWARE SETS]. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

] [Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 612

finish (satin bronze), unless specified otherwise. Finish surface door closers [bronze paint] [prime coat] finish. Provide steel hinges in [BHMA 639 finish (satin bronze plated)] [BHMA 600 finish (primed for painting)]. Provide exposed parts of concealed closers finish to match lock and door trim. Match hardware finish for aluminum doors to match the doors. Provide hardware showing on interior of [bathrooms] [shower rooms] [toilet rooms] [washrooms] [laundry rooms] [and kitchens] in BHMA 629 finish (bright stainless steel) or BHMA 625 finish (bright chromium plated).

## ]2.6 KEY CABINET AND CONTROL SYSTEM

Provide in accordance with ANSI/BHMA A156.5, [Type [E8331 (25 hooks)] [E8341 (125 hooks)] [E8351 (150 hooks)] [E8311 (600 hooks)] [E8321 (700 hooks)].] [Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.]

## PART 3 EXECUTION

### 3.1 INSTALLATION

Provide hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

#### 3.1.1 Weatherstripping Installation

Provide full contact, weathertight seals that allow operation of doors without binding the weatherstripping.

##### 3.1.1.1 Stop Applied Weatherstripping

Fasten in place with color matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

##### 3.1.1.2 Interlocking Type Weatherstripping

Provide interlocking, self adjusting type on heads and jambs and flexible hook type at sills. Nail weatherstripping to door 1 inch on center and to heads and jambs at 4 inch on center.

##### 3.1.1.3 Spring Tension Type Weatherstripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze. Provide stainless steel nails with stainless steel. Space nails not more than 1-1/2 inch on center.

#### 3.1.2 [Lightproofing] [and] [Soundproofing] Installation

Provide as specified for stop applied weatherstripping.

#### 3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws[ in expansion sleeves]. For

aluminum thresholds placed on top of concrete surfaces, coat the underside surfaces that are in contact with the concrete with fluid applied waterproofing as a separation measure prior to placement.

### 3.2 FIRE DOORS AND EXIT DOORS

Provide hardware in accordance with [NFPA 72](#) for door alarms, [NFPA 80](#) for fire doors, [NFPA 101](#) for exit doors, and [NFPA 252](#) for fire tests of door assemblies. [Provide tin-clad fire doors in accordance with [UL 14C](#)].

### 3.3 HARDWARE LOCATIONS

Provide in accordance with [SDI/DOOR A250.8](#), unless indicated or specified otherwise.

- a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.
- b. Mop Plates: Bottom flush with bottom of door.

### 3.4 KEY CABINET AND CONTROL SYSTEM

Locate where [directed][indicated]. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Provide complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

### 3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, errors in cutting and fitting and damage to adjoining work.

### 3.6 HARDWARE SETS

Provide [hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field applied hardware, to the aluminum door and frame manufacturer for use in fabricating doors and frames.]

-- End of Section --



## SECTION 08 71 63

## DETENTION HARDWARE

04/06

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2021) Butts and Hinges
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.5	(2020) Cylinder and Input Devices for Locks
ANSI/BHMA A156.6	(2021) Architectural Door Trim
ANSI/BHMA A156.7	(2016) Template Hinge Dimensions
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.16	(2018) Auxiliary Hardware
ANSI/BHMA A156.18	(2020) Materials and Finishes

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
NFPA 101	(2021) Life Safety Code

## UNDERWRITERS LABORATORIES (UL)

UL 10B	(2008; Reprint May 2020) Fire Tests of Door Assemblies
UL 228	(2006; Reprint Mar 2022) UL Standard for Safety Door Closers-Holders, With or Without Integral Smoke Detectors
UL 437	(2013; Reprint Oct 2017) UL Standard for Safety Key Locks
UL 634	(2007; Reprint Mar 2015) Connectors and Switches for Use with Burglar-Alarm Systems

UL 1034

(2011; Reprint Jun 2020)  
Burglary-Resistant Electric Locking  
Mechanisms

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Detention hardware schedule

## SD-02 Shop Drawings

Type 1 lock

Type 3 lock

Door position switches

Detention hinges

Submit complete system wiring diagrams for locks and controls, following approval of the detention hardware schedule. Indicate electrical requirements for locks and controls.

## SD-03 Product Data

Keys and cylinders

Detention hinges

Detention locks

Door trim

Door position switches

Security door accessories

Submit details of construction and methods of installation, finishes, sizes, shape, alloy and thickness of materials. Include wiring details and electrical specifications.

## SD-10 Operation and Maintenance Data

Detention locks, Data Package 5; G[, [\_\_\_\_]]

DOOR CLOSERS, Data Package 5; G[, [\_\_\_\_]]

Door position switches, Data Package 5; G[, [\_\_\_\_]]

Submit in accordance with Section 01 78 23 OPERATION AND

## MAINTENANCE DATA.

## 1.3 QUALITY ASSURANCE

## 1.3.1 Qualifications of Installer

The work shall be installed by a detention equipment installer approved by the detention hardware manufacturer.

## 1.3.2 Regulatory Requirements

- a. Electrically controlled, monitored, and operated detention hardware and related components shall meet applicable requirements of **NFPA 70**.
- b. Detention hardware for labeled fire doors shall meet applicable requirements of **UL 10B** and be listed (labeled).
- c. Detention hardware for doors that are considered "Means of Egress" shall meet applicable requirements of **NFPA 101**.
- d. Electrically operated detention locks shall meet applicable requirements of **UL 1034** and be listed (labeled).

## 1.3.3 Schedule Requirements

Submit **detention hardware schedule** at the same time hardware samples are submitted. Schedule shall include quantities, manufacturer's catalog numbers, descriptive information, location, sizes, finish, key control symbols including keying systems for each piece. Use the same door marks as shown on the schedule in the contract documents.

## 1.4 DELIVERY, STORAGE, AND HANDLING

## 1.4.1 Keys

Send to the Contracting Officer directly from the manufacturer via registered mail.

## 1.4.2 Detention Hardware

Deliver in a timely manner and store in accordance with the manufacturer's recommendations. Deliver in manufacturer's original container and protect from damage by weather.

## 1.5 HARDWARE COORDINATION CONFERENCE

Conduct a hardware coordination conference for hardware and hollow metal work prior to submittals for the purpose of coordinating the interface of materials that are furnished by the participants listed. Require that a representative of the entity responsible for each of the following functions attend the conference. Notify participants a minimum of 5 working days before the conference.

- a. Contractor
- b. Hollow metal supplier and installer
- c. Detention hollow metal supplier and installer

- d. Hardware supplier
- e. Hardware installer
- f. Detention hardware supplier
- g. Detention hardware installer
- h. Locking control system supplier and installer
- i. Electrical contractor
- j. Contracting Officer

#### 1.6 MAINTENANCE TOOLS

Furnish six tool holders and bits for each different size and type of screw and fastener.

#### 1.7 TEMPLATES

Furnish templates for door and frame preparation.

### PART 2 PRODUCTS

#### 2.1 FINISH

Finish surfaces, painted surfaces and painted items shall be in accordance with [ANSI/BHMA A156.18](#) and as follows:

##### 2.1.1 Painted Surfaces

600.

##### 2.1.2 Finish Surfaces

626 or 630.

##### 2.1.3 Painted Items

689.

#### 2.2 KEYS AND CYLINDERS

[ANSI/BHMA A156.5](#).

##### 2.2.1 Mogul Keys

Keys for pin tumbler locks shall be not less than [2 7/8 inches](#) in length, blade shall be [9/16 inch](#) wide by [1/8 inch](#) thick. Handle shall be [one inch](#) in diameter. Stamp each key with number or letter per code.

##### 2.2.2 Mogul Cylinder

Provide a special "Mogul" cylinder approximately twice the diameter of a commercial mortise lock cylinder with internal parts proportionately larger. Special "Mogul" keys and restricted keying are required. The sale of cut keys and blanks shall be factory regulated to control usage and reproduction. The design shall be wear and pick resistant and shall

include a minimum of five stainless steel 5/32 inch diameter pin tumblers, stainless steel springs, and stainless steel ball bearings which intermesh with the key and pin tumblers. Cylinder shall conform to UL 437.

### 2.2.3 Builders Cylinder

Type E09211A. Keys shall be for restricted use. Cylinder shall conform to UL 437.

## 2.3 KEYING SYSTEM

Keying system shall consist of dissimilar combinations [for each building] with external doors keyed alike; internal corridor doors keyed alike; utility spaces, [wickets, and food passes] keyed alike; each group of cells [or dormitory group] keyed alike but different from other groups. Establish two separate detention key systems; one system shall be for the security Mogul type hardware, and one for the paracentric key system.

## 2.4 DETENTION HINGES

Provide hinges in accordance with ANSI/BHMA A156.1 and ANSI/BHMA A156.7. Type A8191 HT with stainless steel maximum security pin. Type A8192 HT with stainless steel maximum security pin. The 9 inches denotes 4 wire continuous conduction. Screws shall be twist-off or spanner head. Sizing shall be in accordance with standard. Hinges shall be drilled and counter-sunk for proper size machine screws. Use zinc coated hinges on exterior doors with a prime coat. Furnish junction box and mortar shield. Electric hinges shall meet the requirements of UL 634 and be labeled.

## 2.5 DETENTION LOCKS

### 2.5.1 Type 1 Lock

Electro-mechanical solenoid operation lock; jamb mounted for use with security hollow metal doors with the following features:

- a. Solenoid operated 115 V ac continuous duty.
- b. Cylinder operated one or two sides using mogul or builders cylinders.
- c. Lock case 10 gage minimum galvanized cold-rolled steel.
- d. Latch Bolt 3/4 inch throw stainless steel.
- e. Bronze or stainless steel face plate.
- f. Signal switch for latch bolt and deadlocking bolt.
- g. Strike and mounting screws.
- h. Push button in frame if on a cell door.

### 2.5.2 Type 2 Lock

Mechanical deadlock; lever tumbler deadlock for use with security hollow metal doors with the following features:

- a. Paracentric key operated one or two sides.

- b. Six lever tumblers with spring temper brass/bronze springs.
- c. Steel or stainless steel deadbolt with saw resistant insets.
- d. Bolt 3/4 by 2 inches with 3/4 inch throw.
- e. Lock case primed for paint or galvanized.
- f. Lock mount plate including escutcheon, mounting screws, and strike.

#### 2.5.3 Type 3 Lock

Electro-mechanical deadlocking latchlock meeting requirements of UL 10B; jamb mounted in 2 inch face security hollow metal frame with the following features:

- a. Solenoid operated 24 V dc continuous duty.
- b. Cylinder operated one or two side using builders cylinder.
- c. Structural and working parts stainless steel.
- d. Deadlatch 3/4 inch throw stainless steel with saw resistant insets.
- e. Stainless steel deadlocking bolt, base plate, and strike.
- f. Signal switch for lock status.
- g. Plug connectors for conductors.

#### 2.5.4 Type 4 Lock

Mortise lock for security hollow metal swinging doors with the following features:

- a. Mogul cylinder key operated one or two sides.
- b. Cast brass, bronze, or stainless steel bolts. One inch throw with saw resistant inserts. Knob operated deadbolt.
- c. Armored front adjustable 1/8 in 2 inches.
- d. Strike and mounting screws.
- e. Snap locks automatically when door is closed.

#### 2.5.5 Type 5 Lock

Mechanical deadlocking latch lock for security hollow metal swinging doors with the following features:

- a. Mogul key operated one or two sides.
- b. Five lever tumbler with spring temper brass/bronze springs.
- c. Steel or stainless steel latchbolt.
- d. Lock case primed for paint or galvanized.

- e. Lock mounting plate including escutcheon mounting screws and strike.

#### 2.5.6 Type 6 Lock

Mechanical deadlock for use on security hollow metal doors with the following features.

- a. Mogul key operated one or two sides.
- b. Five lever tumblers with spring tempered brass/bronze screws.
- c. Malleable iron case and cover.
- d. Bronze deadbolt  $3/4$  by  $1\ 1/2$  by  $5/8$  inch throw.
- e. Lock case and cover primed for paint.
- f. Lock mounting plate including escutcheon, mounting screws and strike.

#### 2.5.7 Type 7 Lock

Mechanical spring lock for use on chase and access doors with the following features.

- a. Mogul key operated one side only.
- b. Five lever tumblers with spring temper brass/bronze springs.
- c. Malleable iron case and cover.
- d. Bolt retracted by key  $one\ by\ 1/2\ inch\ with\ 7/16\ inch\ throw$ .
- e. Lock case and cover primed for paint.
- f. Mounting screws and strike.

### 2.6 DOOR CLOSERS

#### 2.6.1 Type 1 Door Closers

Surface mounted door closer shall conform to test requirements of [ANSI/BHMA A156.4](#), PT 1, Grade 1.

- a. C02011: Regular Arm Type
- b. C02021: Parallel Arm Type

Closers installed on labeled fire doors shall meet [UL 228](#). Closers shall be non-handed and installed with hex nut and bolts assembly. Exposed screws shall be security type.

#### 2.6.2 Type 2 Door Closer

Concealed overhead closer meeting test as required by [ANSI/BHMA A156.4](#) PT6 Grade 2.

- C05032: Concealed Arm and Track - Butt hinge hung

Closers shall be installed in a  $4\ inch$  head section.

## 2.7 STRIKES

Mortised strikes shall be compatible with the lock which it serves. Provide dust box and switch to monitor lock bolt where indicated in set numbers.

## 2.8 DOOR TRIM

### 2.8.1 Loop Type Pulls

Manganese bronze or stainless steel 8 inches center-to-center surface mounted with spanner type screws. Pulls shall be in accordance with ANSI/BHMA A156.6 J401.

### 2.8.2 Flush Type Pulls

Manganese bronze or stainless steel set for one side or back to back mounting with spanner type screws. Pulls shall be in accordance with ANSI/BHMA A156.6 J403.

### 2.8.3 Door Stops and Holders

#### 2.8.3.1 Type PH1

In accordance with ANSI/BHMA A156.8 -C01511; overhead concealed slide type. Exposed screws shall be spanner head.

#### 2.8.3.2 Type PH2

In accordance with ANSI/BHMA A156.8 -C02511; overhead surface mounted slide type; attached with hex nut and bolt assemblies. Exposed screws shall be spanner head.

#### 2.8.3.3 Type OH3

In accordance with ANSI/BHMA A156.8 -C08511, overhead surface mounted rod type, attached with hex nut and bolt assemblies. Exposed screws shall be spanner head.

#### 2.8.3.4 Type FS1

In accordance with ANSI/BHMA A156.16 -L02131. Bronze.

#### 2.8.3.5 Type FS2

In accordance with ANSI/BHMA A156.16 -L01371. Bronze.

#### 2.8.3.6 Type FS3

In accordance with ANSI/BHMA A156.16 -L02141-L02161. Bronze. Exposed screw shall be spanner head.

## 2.9 DEADBOLTS (HEAD AND FOOT BOLT)

Surface mounted and one inch diameter with 3/4 inch throw. Bolt shall be operated by spanner key case, be malleable iron, or steel with cover. Attachment shall be with spanner head screws.

## 2.10 DOOR POSITION SWITCHES



### 2.10.1 Type 1 Door Position Switch

Mechanically mortised door position switch with the following features:

- a. Components concealed when door is in closed position.
- b. Switch mechanism housing mortises into door frame headers.
- c. Galvanized steel actuator arm.
- d. Actuator arm track mortises into the top rail of the door.
- e. Allows door opening 180 degrees.
- f. Switch monitors door position within 3/4 inch from the leading edge of the door to the door stop.
- g. Unit constructed of brass and plated steel. The exposed face plate galvanized steel.
- h. Switch single pole, double throw type with a rating of 5 amps at 125/250 V ac.
- i. Color coded wires with a pair of cable connectors.

### 2.10.2 Type 2 Door Position Switch

A magnetic door position switch for meeting requirements for [UL 634](#) for mounting in head of door to indicate closed door position. Provide the following features:

- a. Mortised into door frame header.
- b. Potted components.
- c. Life expectancy per manufacturer - over 1 million operations.
- d. Maximum contact rating:
  - (1) Current, resistive load - 1 amp.
  - (2) Power, resistive load - 24 V ac.
- e. Maximum current at 24 V ac, resistive load - 1 amp.

## 2.11 SECURITY DOOR ACCESSORIES

### 2.11.1 Wall Bumpers

In accordance with [ANSI/BHMA A156.16](#) Type L02101.

### 2.11.2 Thresholds

Aluminum extrusion minimum thickness 0.172 by 5 inches wide by 1/2 inch rise with panic stop and vinyl or neoprene insert.

### 2.11.3 Drip Strip

Extruded galvanized steel strip 2 1/2 inches wide with 5/8 inch back strip. Attach to shower doors with a continuous weld.

#### 2.11.4 Weatherstrip

Apply for head and jambs, pressure sensitive adhesive silicone rubber seal.

### 2.12 SCREWS AND FASTENERS

Comply with detention manufacturer's standard fastening hardware and recommendations for size, type, and material.

#### 2.12.1 Fabrication

Finish exposed fasteners to match hardware fastened. Fabricate fasteners of the same metal as hardware fastened, except use plated brass or stainless steel for fastening aluminum.

#### 2.12.2 Location

Provide spanner head screws and fasteners for exposed hardware.

### 2.13 TEMPLATE HARDWARE

Hardware to be applied to frames and to doors shall be made to template.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Examine doors, frames, and hardware for damage, defects, and suitability for intended use. Inspect components and adjacent areas of construction for conditions that could be detrimental to the proper operation or performance of the detention hardware.

### 3.2 INSTALLATION

Sequence and procedures for installation shall be in accordance with detention hardware manufacturer's instructions.

### 3.3 ADJUSTMENT AND CLEANING

Examine hardware for complete and proper installation. Lubricate bearing surfaces of moving parts. Adjust hinges, locks, and keepers to function properly. Test keys for smooth operation and for conformance to approved keying system. Hardware shall operate freely without binding and be properly aligned. Protect hardware from paint, stains, weather, and other damage until acceptance of the work.

### 3.4 FIELD QUALITY CONTROL

After hardware has been installed and placed in operating order, conduct performance tests which shall demonstrate to the Contracting Officer that the hardware operates as specified. Remove items that fail to conform to the requirements specified and replace with new.

### 3.5 TRAINING

Upon completion of the work and at a time designated by the Contracting

Officer, a manufacturer's technical service representative or manufacturer's authorized representative for the locking control system, shall instruct Government personnel in the proper operation, troubleshooting, maintenance, safety, and emergency procedures of the system. The period of instruction shall be four 8-hour sessions. Conduct training at the job site. The Government shall have the option to video tape training sessions. Notify the Contracting Officer at least two weeks in advance.

### 3.6 HARDWARE SETS

<b>Abbreviations Used in Hardware Sets</b>	
PC	Prime Coat
EC	Solenoid operated continuous duty
MC	Motor operated continuous duty
L	Limit switch tripped by spring bolt
LL	Limit switch tripped by spring bolt and roller bolt
H	Holdback feature
S	Square bolt
K	Knob feature
SHS	Scanner Head Screws
AL	Aluminum
<b>SH-1</b>	
(3)	Type A8191HT hinges by Prime Coat by Spanner Head Screws
(1)	Type 1 lock by keyed 1 side by EMCLL by SHS
(1)	Loop type door pulls
(1)	Flush type pull by SHS
(1)	Wall Bumper by SHS
<b>SH-2</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 1 lock by keyed 2 sides by EHMLL by SHS
(2)	Loop type door pulls

(1)	Type 1 door position switch by SHS
(1)	Type 1 door closer by AL by SHS
(1)	Wall bumpers by SHS
<b>SH-3</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 1 lock by keyed 2 sides by EHMLL by SHS
(2)	Loop type door pulls
(1)	Type 1 door position switch by SHS
(1)	Type 1 door closer by AL by SHS
(1)	Threshold
(1)	Weatherstrip
<b>SH-4</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 1 lock by keyed 2 sides by ELL by SHS
(2)	Loop type door pulls by SHS
(1)	Type 2 door position switch by SHS
(1)	Type 2 door closer by AL by SHS
<b>SH-5</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 2 locks by keyed 2 sides by PC by SHS
(1)	Type 1 door closer by AL by SHS
(1)	Loop type door pull
(1)	Wall bumper by SHS
<b>SH-6</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 2 lock by keyed 2 sides by GALV. by SHS
(1)	Loop type door pull

(1)	Type 1 door closer by AL by SHS
(1)	Threshold by AL by SHS
(1)	Weatherstrip by AL by SHS
<b>SH-7</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 2 lock by keyed 2 sides by PC by SHS
(1)	Mortise strike with dust box and switch for lock bolt monitor by PC by SHS
(1)	Type 1 door position switch by SHS
(1)	Loop type door pull
<b>SH-8</b>	
(5)	Type A8191HT hinges by PC by SHS
(1)	Type A8191HT PC by SHS
(1)	Type 2 lock by keyed 2 sides by PC by SHS
(1)	Mortise strike with dust box and switch for bolt monitor by PC by SHS
(2)	Type 1 door position switch by SHS
(1)	Loop type door pull by SHS by outside active leaf
(1)	Head and Foot bolt by spanner key by receptacles by PC by SHS by inactive leaf
(1)	Threshold by AL by SHS
(1)	Weatherstrip
<b>SH-9</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 3 lock by keyed 1 side by double face plate by 24VDC by SHS
(1)	Type 1 door position switch by SHS
(1)	Loop type door pull by SHS
(1)	Flush type door pull (inmate side) by SHS

<b>SH-10</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 4 lock by keyed 2 sides by SHS
(1)	Mortise strike with dust box and switch for bolt monitor by PC by SHS
(1)	Type 2 door position switch by SHS
(1)	Type 2 door closer by AL by SHS
(1)	Wall bumper by SHS
<b>SH-11</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 6 lock by keyed 1 side by PC by SHS
<b>SH-12</b>	
(3)	Type A8191HT hinges by SHS
(1)	Type 5 lock by keyed 1 side by PC by SHS
(1)	Mortise strike with dust box by PC by SHS
(1)	Loop type door pull by SHS
(1)	Flush type pull by SHS (inmate side)
<b>SH-13</b>	
(3)	Type A8191HT hinges by SHS
(1)	Type 5 lock by keyed 2 sides by PC by SHS
(1)	Mortise strike with dust box and switch for bolt monitor by PC by SHS
(1)	Type 1 door closer
(1)	Type 1 door position switch by SHS
(2)	Loop type door pulls by SHS
(1)	Wall bumper by SHS
<b>SH-14</b>	
(3)	Type A8191HT hinges by SHS

(1)	Type 1 lock by keyed 2 sides by EMCLL by SHS
(2)	Loop type door pull by SHS
(1)	Type 1 door closer by AL by SHS
(1)	Type 1 door position switch by SHS
<b>SH-15</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 1 lock by keyed 1 side by MCLL by SHS
(1)	Loop type door pull by SHS
(1)	Type 2 door closer by AL by SHS
(1)	Type 2 door position switch by SHS
(1)	Threshold by AL by SHS
(1)	Weatherstripping
<b>SH-16</b>	
(3)	Type A8191HT hinges by PC by SHS
(1)	Type 3 lock by head mount by 24VDC by SHS
(1)	Loop type door pull by SHS (outside)
(1)	Flush type door pull by SHS (inside)
(1)	Type 1 door position switch by SHS
(1)	Type 1 door closer by AL by SHS
(1)	Pushbutton by SHS
<b>SH-17</b>	
(2)	Type A8192HT hinges by PC by SHS
(1)	Type 7 Lock
<b>SH-18</b>	
(3)	Type A8191HT by PC by SHS
(1)	Type 3 lock by keyed 2 sides by double face plate by 24 VDC by SHS

(1)	Type 2 door position switch by SHS
(1)	Loop type door pull by SHS
(1)	Type 1 Closer
<b>SH-19</b>	
(3)	Type A8191HT hinges by SHS
(1)	Type 1 lock by keyed 2 sides by Galvanized EMCLL by SHS
(2)	Loop type pulls by SHS
(1)	Type 1 Door position switch by SHS
(1)	Type 1 closer by AL by SHS
(1)	Weatherstripping

-- End of Section --



## SECTION 08 81 00

## GLAZING

05/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants
- AAMA GDSG-1 (1987) Glass Design for Sloped Glazing
- AAMA TIR A7 (2011) Sloped Glazing Guidelines

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## ASTM INTERNATIONAL (ASTM)

- ASTM C509 (2006; R 2021) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- ASTM C864 (2005; R 2015) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
- ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants
- ASTM C1021 (2008; R 2014) Standard Practice for Laboratories Engaged in Testing of Building Sealants
- ASTM C1036 (2021) Standard Specification for Flat Glass
- ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
- ASTM C1087 (2016) Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
- ASTM C1172 (2019) Standard Specification for

	Laminated Architectural Flat Glass
ASTM C1184	(2014) Standard Specification for Structural Silicone Sealants
ASTM C1281	(2016) Standard Specification for Preformed Tape Sealants for Glazing Applications
ASTM C1376	(2015) Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D2287	(2019) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D4802	(2016) Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E413	(2022) Classification for Rating Sound Insulation
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E2190	(2010) Standard Specification for Insulating Glass Unit Performance and Evaluation
ASTM E2226	(2015; R 2019b) Standard Practice for Application of Hose Stream
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2912	(2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings

## GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2008) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual

<b>IANA Standards Manual</b>	(2008) Engineering Standards Manual
INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)	
<b>IGMA TB-1200</b>	(1983; R 2016) Guidelines for Insulating Glass Dimensional Tolerances
<b>IGMA TB-3001</b>	(2001) Guidelines for Sloped Glazing
<b>IGMA TM-3000</b>	(1990; R 2016) North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use
NATIONAL FENESTRATION RATING COUNCIL (NFRC)	
<b>NFRC 100</b>	(2020) Procedure for Determining Fenestration Product U-Factors
<b>NFRC 200</b>	(2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
<b>NFPA 80</b>	(2022) Standard for Fire Doors and Other Opening Protectives
<b>NFPA 251</b>	(2006) Standard Methods of Tests of Fire Resistance of Building Construction and Materials
<b>NFPA 252</b>	(2022) Standard Methods of Fire Tests of Door Assemblies
<b>NFPA 257</b>	(2022) Standard on Fire Test for Window and Glass Block Assemblies
U.S. DEPARTMENT OF ENERGY (DOE)	
<b>Energy Star</b>	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
<b>16 CFR 1201</b>	Safety Standard for Architectural Glazing Materials
UNDERWRITERS LABORATORIES (UL)	
<b>UL 752</b>	(2005; Reprint Jan 2021) UL Standard for Safety Bullet-Resisting Equipment
<b>UL MEAPD</b>	(2011) Mechanical Equipment and Associated Products Directory (online version is listed under Certifications at <a href="http://www.ul.com">www.ul.com</a> )

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Insulating Glass

Plastic Glazing

Glazing Accessories

Sealants

Joint Backer

SD-04 Samples

Insulating Glass

Plastic Sheet

Glazing Compound

Glazing Tape

Sealing Tapes

[ SD-07 Certificates

Insulating Glass

Plastic Glazing

] SD-08 Manufacturer's Instructions

Setting and Sealing Materials

Glass Setting

SD-11 Closeout Submittals

Warranty for Insulated Glass Units

[ Warranty for Polycarbonate Sheet

] [ Warranty for Monolithic Reflective Glass

] [ Warranty for Monolithic Opacified Spandrel

]

[ Energy Efficient Equipment for Residential Windows; S

] [1.3 SYSTEM DESCRIPTION

Fabricate and install watertight and airtight glazing systems to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of [glazing accessories](#), or defects in the work. Glazed panels must comply with the safety standards, in accordance with [ANSI Z97.1](#), and comply with indicated wind/snow loading in accordance with [ASTM E1300](#). [Sloped glazing must comply with [AAMA GDSG-1](#) and [AAMA TIR A7](#), and [IGMA TB-3001](#).]

#### [1.3.1 Glazing for Passive Solar and Dynamic Control Fenestration

Identify glazing for Passive Solar and Dynamic Control Fenestration noted as part of a passive solar heating system and/or chromogenic fenestration and evaluate separately from other fenestration. Glazing for use in Passive Solar systems are exempt from SHGC requirements. Area-weighted averaging of chromogenic fenestration with other non-chromogenic fenestration is not permitted. For chromogenic fenestration systems, the lower-rated labeled SHGC must be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity.

#### ]1.4 QUALITY CONTROL

Submit two [8 by 10 inch](#) samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, [\_\_\_\_\_] and insulating glass units.

Submit three samples of each other material. Samples of plastic sheets must be minimum [5 by 7 inches](#).

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above [40 degrees F](#) and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

#### 1.7 WARRANTY

##### 1.7.1 Warranty for [Insulated Glass Units](#)

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

##### 1.7.2 [Warranty for Polycarbonate Sheet](#)

For a 5-year period following acceptance of the work:

- a. Warranty Type I, Class A (UV stabilized) sheets against breakage;
- b. Warranty Type III (coated, mar-resistant) sheets against breakage and against coating delamination;
- c. Warranty Type IV (coated sheet) against breakage and against yellowing;
- d. Warranty extruded polycarbonate profile sheet against breakage.

For a 10-year period following acceptance of the work, warranty Type IV against yellowing and loss of light transmission.

#### [1.7.3 Monolithic Reflective Glass

Manufacturer must warrant the monolithic reflective glass to be free of peeling or deteriorating of coating for a period of 10 years after Date of Substantial Completion. Warranty must be signed by manufacturer.

#### ] [1.7.4 Monolithic Opacified Spandrel

Manufacturer must warrant the opacifier film on the spandrel to be free of peeling for a period of five years after Date of Substantial Completion. Warranty must be signed by manufacturer.

### ] PART 2 PRODUCTS

#### 2.1 PRODUCT SUSTAINABILITY CRITERIA

##### [2.1.1 Energy Efficient Equipment for Residential Windows

Provide Energy Star residential windows in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph ENERGY EFFICIENT PRODUCTS.

#### ] 2.2 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

##### 2.2.1 Clear Glass

[ For interior glazing (i.e., pass and observation windows), 1/4 inch thick glass should be used.

] Type I, Class 1 (clear), Quality [q4 (A)] [q5 (B)]. Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 1/8 inch float glass for openings up to and including 15 square feet, 3/16 inch for glazing openings over 15 square feet but not over 30 square feet, and 1/4 inch for glazing openings over 30 square feet but not over 45 square feet.

##### 2.2.2 Annealed Glass

Annealed glass must be Type I transparent flat type, [Class 1 - clear, ] Quality q3 - glazing select, [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient, conforming to ASTM C1036.

##### 2.2.3 Heat-Absorbing Glass

Type I, Class 2 (tinted), Quality [q3 (select)] [q4 (A)], [\_\_\_\_\_] inch thick, [blue][green] in color, [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient, conforming to [ASTM C1036](#).

#### 2.2.4 Reflective Coating Vision Glass

[ASTM C1376](#)

#### 2.2.5 Wired Glass

Provide UL listed glass for fire-rated windows rated for [45] [20] minutes when tested in accordance with [ASTM E2226](#). Wired glass must be Type II flat type, Class [1 - translucent] [2 - tinted, heat-absorbing] [3 - tinted, light-reducing], Quality [q7 - decorative] [q8 - glazing], Form [1 - wired and polished both sides] [2 - patterned and wired], [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient, conforming to [ASTM C1036](#). Wire mesh must be polished stainless steel Mesh [1 - diamond] [2 - square] [3 - parallel]. Wired glass for fire-rated windows must bear an identifying UL label or the label of a nationally recognized testing agency, and be rated for [20] [45] minutes when tested in accordance with [NFPA 257](#). Wired glass for fire-rated doors must be tested as part of a door assembly in accordance with [NFPA 252](#).

#### 2.2.6 Patterned Glass

Type II, Class 1 (translucent), Form 3 (patterned), Quality q5 or q6 (decorative), Finish [F1 (patterned one side)] [F2 (patterned two sides)], Pattern [P1 (linear)] [P2 (geometric)] [P3 (random)] [P4 (special)], [[\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient.] [1/8] [7/32] inch thick. [ Provide [\_\_\_\_\_] ].]

#### 2.2.7 Laminated Glass

[[ASTM C1172](#), Laminated glass fabricated from two nominal [1/8] [\_\_\_\_\_] inch pieces of Type I, Class 1, [Class \_\_\_\_\_], Quality Q3, flat annealed [ultraclear]; [clear] [\_\_\_\_\_] glass conforming to [ASTM C1036](#).] [[ASTM C1172](#), Laminated glass fabricated from two nominal [1/8] [\_\_\_\_\_] inch pieces of Type I, Kind [HS] [FT], Condition [A] [B] [C], Class 1, Class [\_\_\_\_\_] , Quality Q3, flat [heat strengthened] [fully tempered] [clear] [\_\_\_\_\_] glass conforming to [ASTM C1048](#).] Flat glass to be laminated together with a minimum of 0.030 inch inch thick, clear [polyvinyl butyral] [ionoplast] [cast-in-place liquid resin] laminate, conforming to requirements of [16 CFR 1201](#) and [ASTM C1172](#). The total thickness of nominally 1/4 [\_\_\_\_\_] inches. Color to be [clear] [gray] [bronze] [\_\_\_\_\_] . The total thickness of nominally [\_\_\_\_\_] inch.

[ Design window glazing using a dynamic analysis[ testing from airblast loading in accordance with [ASTM F1642/F1642M](#) by an independent testing agency regularly engaged in blast testing] to prove the glazing will provide performance equivalent to or better than a [low] [very low] [\_\_\_\_\_] hazard rating in accordance with [ASTM F2912](#) for the peak positive pressure of [\_\_\_\_\_] pounds per square inch (psi) and peak positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec).

#### ]2.2.8 Bullet-Resisting Glass

Fabricated from Type I, Class 1, Quality q3 glass with polyvinyl butyral plastic interlayers between the layers of glass and listed by [UL MEAPD](#) as

bullet resisting, with a rating Level of [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [\_\_\_\_\_] in accordance with [UL 752](#). Provide [\_\_\_\_\_] [where indicated].

## [2.2.9 Mirrors

### 2.2.9.1 Glass Mirrors

Glass for mirrors must be Type I transparent flat type, Class 1-clear, Glazing Quality q1 [1/4 inch](#) thick conforming to [ASTM C1036](#). Glass must be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating must be highly adhesive pure silver coating of a thickness which must provide reflectivity of 83 percent or more of incident light when viewed through [1/4 inch](#) thick glass, and must be free of pinholes or other defects. Copper protective coating must be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and must be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint must consist of two coats of special scratch and abrasion-resistant paint, and must be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

### ]2.2.10 One-Way Vision Glass (Transparent Mirrors)

Type I, Class 1, Quality q1, [1/4 inch](#) thick, coated on one face with a hard, adherent film of chromium or other approved coating of equal durability. Glass must transmit not less than 5 percent or more than 11 percent of total incident visible light and must reflect from the front surface of the coating not less than 45 percent of the total incident visible light. [ Provide [\_\_\_\_\_] ].

### 2.2.11 Tempered Glass

[ASTM C1048](#), Kind FT (fully tempered), Condition A (uncoated), Type I, Class [1 (transparent)] [2 (tinted heat absorbing)], Quality q3, [\_\_\_\_\_] [inch](#) thick, [\_\_\_\_\_] percent light transmittance, [\_\_\_\_\_] percent shading coefficient conforming to [ASTM C1048](#) and [GANA Standards Manual](#). Color must be [[clear] [bronze] [gray] [\_\_\_\_\_] ]. [Provide [\_\_\_\_\_] ] [and wherever safety glazing material is indicated or specified].

### 2.2.12 Heat-Strengthened Glass

[ASTM C1048](#), Kind HS (heat strengthened), Condition A (uncoated), Type I, Class [1 (clear)] [2 (tinted heat absorbing)], Quality q3, [\_\_\_\_\_] [inch](#) thick. [Provide [\_\_\_\_\_] ].

### 2.2.13 Spandrel Glass

#### 2.2.13.1 Ceramic-Opacified Spandrel Glass

Ceramic-opacified spandrel glass must be Kind HS heat-strengthened transparent flat type, Condition B, coated with a colored ceramic material on No. 2 surface, Quality q3 - glazing select, [\_\_\_\_\_] [inch](#) thick, conforming to [ASTM C1048](#). Glass performance must be [R-Value/Winter Nighttime](#) [\_\_\_\_\_] , shading coefficient [\_\_\_\_\_] . Color must be [\_\_\_\_\_] .

#### 2.2.13.2 Film-Opacified Spandrel Glass

Film-opacified spandrel glass must be Kind HS heat-strengthened transparent



flat type, Quality q3 - glazing select, Condition C glass with a polyester or polyethylene film 2 mils to 5 mils thick attached to No. 2 surface of a sputtered solar-reflective film, conforming to ASTM C1048. Film opacification must be compatible to and specifically developed for application to solar reflective films. Glass performance must be R-Value/Winter Nighttime [\_\_\_\_], shading coefficient [\_\_\_\_]. Color must be [\_\_\_\_].

### 2.2.13.3 Spandrel Glass With Adhered Backing

ASTM C1048, Kind HS or FT, Condition B (ceramic coated), Type I, Quality q5, [\_\_\_\_] inch thick and must pass the fallout resistance test specified in ASTM C1048. [Provide [\_\_\_\_].]

### [2.2.14 Fire/Safety Rated Glass

#### [2.2.14.1 Fire Protection Rated Glass

Clear tempered and meet 16 CFR 1201 Category I (under 9 square feet) or II (over 9 square feet) impact safety standard. Glass to make [20] [45] minute rating when tested in accordance with NFPA 257 and NFPA 252. Glass to be permanently labeled with appropriate markings.

#### ] [2.2.14.2 Fire Resistive Rated Glazing

Fire resistive glass must be laminated, with intumescent interlayer, Type I transparent flat type, Class 1-clear and meet 16 CFR 1201 Category I (under 9 square feet) or II (over 9 square feet). Glass must have a [60] [90] [120] minute rating when tested in accordance with ASTM E119 and NFPA 251. Glass must be permanently labeled with appropriate markings.

### ] ] 2.3 INSULATING GLASS UNITS

[Two] [Three] panes of glass separated by a dehydrated airspace[, filled with argon gas] [, filled with krypton gas,] [, filled with aerogel] and hermetically sealed, conforming to ASTM E2190. Submit performance and compliance documentation for each type of insulating glass.

[ Insulated glass units must have a Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_] determined according to NFRC 200 and a U-factor maximum of [\_\_\_\_] Btu per square foot by hr by degree F in accordance with NFRC 100.

] [See section[s] [\_\_\_\_] for energy performance requirements for glazed systems (glazing and frames).] [Glazed panels must be rated for not less than [26] [30] [35] [\_\_\_\_] Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.]

Dimensional tolerances must be as specified in IGMA TB-1200. Spacer must be black, roll-formed, [thin-gauge, C-section steel] [steel-reinforced butyl rubber] [thermally broken aluminum] [polyurethane and silicon foams], with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal must be compressed polyisobutylene and the secondary seal must be a specially formulated silicone.

The inner light must be [ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3] [ASTM C1036, Type I, Class 1, Quality q4, [\_\_\_\_] inch

thick] [ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class 1 (transparent), Quality q4, [\_\_\_\_\_] inch thick]. [The intermediate light must be [ASTM C1172, clear annealed flat glass Type I, Class I, Quality q3] [ASTM C1036, Type I, Class 1, Quality q4, [\_\_\_\_\_] inch thick] [ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class 1 (transparent), Quality q4, [\_\_\_\_\_] inch thick].] The outer light must be [ASTM C1036, Type I, Class [1 (transparent)] [2 (tinted heat absorbing)], [2 (solar-reflective)], Quality q4, [\_\_\_\_\_] inch thick] [ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class [1 (clear)] [2 (tinted heat absorbing)] [solar-reflective], Quality q4, [\_\_\_\_\_] inch thick].

#### 2.3.1 Low Emissivity Coatings

Interior and exterior glass panes for Low-E insulating units must be Type I annealed flat glass, Class [1-clear] [2-tinted] with anti-reflective low-emissivity coating or heat-strengthened or fully tempered glass complying with ASTM C1048, Condition C on [No. 2 surface (inside surface of exterior pane)] [No. 3 surface (inside surface of interior pane)], Quality q3 - glazing select, conforming to ASTM C1036. Glass performance must be U value maximum of [\_\_\_\_\_] [Btu/hr-ft<sup>2</sup>-F], Solar Heat Gain Coefficient (SHGC) maximum of [\_\_\_\_\_] . Color must be [green] [gray] [bronze] [blue] [\_\_\_\_\_] .

#### 2.4 PLASTIC GLAZING

Plastic glazing must have a U-factor maximum of [\_\_\_\_\_] Btu per square foot by hr by degree F. [Plastic glazing must include a [0.63] [1.26] [\_\_\_\_\_] inch layer of aerogel between panels.]

Certificates stating that the plastic glazing meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

##### 2.4.1 Acrylic Sheet

ASTM D4802, [Type I, regular] [Type II, heat resistant,] [clear and smooth on both sides] [translucent, textured on both sides,] [gray tint,] [bronze tint,] ultraviolet stabilized, [scratch resistant,] [\_\_\_\_\_] [0.236] [\_\_\_\_\_] in. thick.

##### 2.4.2 Polycarbonate Sheet

ANSI Z97.1, [Clear and smooth both sides] [Translucent, textured both sides] [Gray tint] [Bronze tint] [mar-resistant] [high abrasion resistant], ultraviolet stabilized, [\_\_\_\_\_] inch thick and listed in UL MEAPD as burglar resisting.

##### 2.4.3 Extruded Polycarbonate Profiled Sheet

Provide [double] [triple] walled, surface treated for improved UV resistance, offering thermal efficiency and impact strength.

##### 2.4.4 Bullet-Resistant Plastic Sheet

Cast acrylic sheet or mar-resistant polycarbonate sheet laminated with a special interlayer, and listed in UL 752 as bullet resisting, Class [I] [II] [III], [clear] [\_\_\_\_\_] in color. [ Provide [\_\_\_\_\_] .]

#### 2.5 SETTING AND SEALING MATERIALS

Provide as specified in the [GANA Glazing Manual](#), [IGMA TM-3000](#), [IGMA TB-3001](#), and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted must be gray or neutral color. Sealant testing must be performed by a testing agency qualified according to [ASTM C1021](#).

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified. [ Include cleaning instructions for plastic sheets.]

#### 2.5.1 Putty and Glazing Compound

Provide glazing compound as recommended by manufacturer for face-glazing metal sash. Putty must be linseed oil type. Do not use putty and glazing compounds with insulating glass or laminated glass.

#### 2.5.2 [Glazing Compound](#)

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

#### 2.5.3 Sealants

Provide elastomeric [and structural] sealants.

##### 2.5.3.1 Elastomeric Sealant

[ASTM C920](#), Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing [wood] [and] [metal] sash. [Sealants](#) must be chemically compatible with setting blocks, edge blocks, and sealing tapes[, with sealants used in manufacture of insulating glass units] [, and with plastic sheet]. Color of sealant must be white.

##### 2.5.3.2 Structural Sealant

[ASTM C1184](#), Type S.

#### 2.5.4 [Joint Backer](#)

[Joint backer](#) must have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

#### 2.5.5 Glazing Tapes

##### 2.5.5.1 Back-Bedding Mastic Glazing Tapes

Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with [ASTM C1281](#) and [AAMA 800](#) for products indicated below:

- a. AAMA 804.3 tape, where indicated.
- b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

- c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

#### 2.5.5.2 Expanded Cellular Glazing Tapes

Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

- a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
- b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

#### 2.5.6 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes must be chemically compatible with the product being set.

#### 2.5.7 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks must be dense extruded type conforming to ASTM C509 and ASTM D395, Method B, Shore A durometer between 70 and 90. Edge blocking must be Shore A durometer of 50 (plus or minus 5). Provide silicone setting blocks when blocks are in contact with silicone sealant. Profiles, lengths and locations must be as required and recommended in writing by glass manufacturer. Block color must be [black] [\_\_\_\_\_].

#### 2.5.8 Glazing Gaskets

Glazing gaskets must be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening must be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets must be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Provide glazing gasket profiles as recommended by the manufacturer for the intended application.

##### 2.5.8.1 Fixed Glazing Gaskets

Fixed glazing gaskets must be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C509, Type 2, Option 1.

##### 2.5.8.2 Wedge Glazing Gaskets

Wedge glazing gaskets must be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C864, Option 1, Shore A durometer between 65 and 75.

##### 2.5.8.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing must be permanent, elastic,

non-shrinking, non-migrating, watertight and weathertight.

#### 2.5.9 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers. Use [ASTM C1087](#) to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to surface.

### [2.6 MIRROR ACCESSORIES

#### 2.6.1 Mastic

Mastic for setting mirrors must be a [polymer] [\_\_\_\_\_] type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Provide mastic compatible with mirror backing paint, and as approved by mirror manufacturer.

#### 2.6.2 Mirror Frames

Provide mirrors with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames must be 1-1/4 by 1/4 by 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material must be provided with mirror frames.

#### 2.6.3 Mirror Clips

Provide clips with concealed fasteners of type to suit wall construction material.

### ]PART 3 EXECUTION

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

#### 3.1 PREPARATION

Preparation, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

#### 3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Aluminum windows, wood doors, and wood

windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

### 3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

### 3.2.2 Patterned Glass

Set glass with one patterned surface with smooth surface on the weather side. When used for interior partitions, place the patterned surface in same direction in all openings.

### 3.2.3 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation must conform to applicable recommendations of [IGMA TB-3001](#) and [IGMA TM-3000](#).

### 3.2.4 Installation of Wire Glass

Install glass for fire doors in accordance with installation requirements of [NFPA 80](#).

### 3.2.5 Installation of Heat-Absorbing Glass

Provide glass with clean-cut, factory-fabricated edges. Field cutting will not be permitted.

### 3.2.6 Installation of Laminated Glass

Sashes which are to receive laminated glass must be weeped to the outside to allow water drainage into the channel.

### 3.2.7 Plastic Sheet

Conform to manufacturer's recommendations for edge clearance, type of sealant and tape, and method of installation.

## 3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass must be clean at the time the work is accepted. [ Clean plastic sheet in accordance with manufacturer's instructions.]

## 3.4 PROTECTION

Protect glass work immediately after installation. Identify glazed openings with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Protect reflective glass with a protective material to eliminate any contamination of the reflective coating. Place protective material far enough away from the coated glass to allow air to

circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Remove and replace glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities with new units.

-- End of Section --

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## SECTION 08 88 53

## DETENTION AND SECURITY GLAZING

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA MCWM-1 (1989) Metal Curtain Wall Manual

## ASTM INTERNATIONAL (ASTM)

ASTM C158 (2002; R 2017) Standard Test Methods for Strength of Glass by Flexure (Determination of Modulus of Rupture)

ASTM C864 (2005; R 2015) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants

ASTM C1036 (2021) Standard Specification for Flat Glass

## GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (2008) Glazing Manual

GANA Sealant Manual (2008) Sealant Manual

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2022) Standard for Fire Doors and Other Opening Protectives

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-59502 (Basic; Notice 1) Plastic Sheet, Polycarbonate

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-03 Product Data

#### Glazing materials

Include glass manufacturer's printed literature for setting and sealing materials and for cleaning of each type of glazing material specified.

### SD-04 Samples

#### Glazing materials

Submit samples, 10 inches square, factory labeled, for each type of glazing specified.

### SD-08 Manufacturer's Instructions

#### Glass setting

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in their original unopened containers, plainly labeled with manufacturers' names and brands. Store all glass and setting materials in safe, dry locations and do not unpack until needed for installation. Handle and install materials in a manner that protects them from damage.

## 1.4 ENVIRONMENTAL CONDITIONS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising unless approved provisions are made to warm the glass and rabbet surfaces. Provide sufficient ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during wet weather.

## 1.5 WARRANTY

Warranty glass units against development of material obstruction to vision as a result of delamination, other than through glass breakage for at least a 5 year period from the date of acceptance of the work. Provide new units for units failing to comply with terms of this warranty no later than 45 working days following receipt of notice from the Government.

## PART 2 PRODUCTS

### 2.1 DETENTION GLAZING ASSEMBLIES

#### 2.1.1 Glass-Clad Polycarbonate

Two glass outer layers (plies), bonded to a core of one or more plastic layers (plies).

#### 2.1.2 Plastic Laminated (Bonded) Construction

Two or more layers (plies) of plastic sheet bonded together with polyurethane.

#### 2.1.3 Glass Laminated (Bonded) Construction

Two or more layers (plies) of chemically-strengthened float glass bonded together with polyvinyl butyral (PVB).

## 2.2 DETENTION GLAZING MATERIALS

### 2.2.1 Glass, Chemically Strengthened

ASTM C158, transparent prestressed.

### 2.2.2 Glass, Annealed, Wire

ASTM C1036, Type II, Class 1, form 1, Quality q8, 1/4 inch thick, with diamond or square mesh.

### 2.2.3 Polycarbonate, Transparent, Rigid Sheet Plastic

CID A-A-59502, [Type I Grade A] [Type III Grade A] [clear] [transparent], thickness as specified.

## 2.3 DETENTION GLAZING TYPES

- a. Type 1: Tempered Glass; Conform to Section 08 81 00 GLAZING.
- b. Type 2: 7/16 inch nominal glass-clad polycarbonate: 1/8 inch clear chemically-strengthened glass, 0.050 inch polyurethane interlayer, 1/8 inch polycarbonate sheet, 0.050 inch polyurethane interlayer, 1/8 inch clear chemically-strengthened glass.
- c. Type 3: 3/8 inch nominal laminated plastic: 3/16 inch mar-resistant (hard coat) polycarbonate (threat side), 0.034 inch polyurethane interlayer, 3/16 inch polycarbonate sheet.
- d. Type 4: 7/16 inch nominal laminated glass: 1/8 inch clear chemically-strengthened glass, 0.090 inch polyvinyl butyral interlayer, 1/8 inch clear chemically-strengthened glass, 0.090 inch polyvinyl butyral interlayer, 1/8 inch clear chemically-strengthened glass.
- e. Type 4W: Add a separate (not laminated) 1/4 inch annealed wire glass on staff side to Type 4.
- f. Type 5: 9/16 inch nominal glass-clad polycarbonate: 1/8 inch clear chemically-strengthened glass (threat side), 0.050 inch polyurethane interlayer, 1/4 inch polycarbonate sheet, 0.050 inch polyurethane interlayer, 1/8 inch clear chemically-strengthened glass.
- g. Type 5W: Add a separate (not laminated) 1/4 inch annealed wire glass on staff side to Type 5.
- h. Type 6: 5/16 inch nominal laminated glass: 1/8 inch clear chemically-strengthened glass, 0.090 inch polyvinyl butyral interlayer, 1/8 inch clear chemically-strengthened glass.

## 2.4 SETTING MATERIALS

Provide types required for the applicable setting method specified in GANA Glazing Manual and GANA Sealant Manual, except as modified in this section. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view shall be gray or neutral color.

#### 2.4.1 Glazing Compound

Use for face glazing metal sash. Verify compatibility with materials in glazing assembly.

#### 2.4.2 Elastomeric Sealant

**ASTM C920**, Type S, Grade NS, Class 12.5, use NT. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes [, and with plastic sheet]. Color of sealant shall be white.

#### 2.4.3 Preformed Channels

Neoprene, **AAMA MCWM-1**, as recommended by the glass manufacturer for the particular condition. Channels shall be chemically compatible with plastic sheet.

#### 2.4.4 Sealing Tapes

Preformed, semisolid, polymeric-based material of proper size and compressibility for the particular condition. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. [Tapes shall be chemically compatible with plastic sheet.]

#### 2.4.5 Setting Blocks and Edge Blocks

**ASTM C864** neoprene of 70 to 90 Shore "A" durometer hardness, chemically compatible with sealants used, and of sizes recommended by the glass manufacturer.

#### 2.4.6 Accessories

As required to provide a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

### PART 3 EXECUTION

#### 3.1 GLAZING TYPES

Locations and types of glass for use in glazed openings as indicated.

#### 3.2 PREPARATION

Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Leave labels in place until the installation is approved. Securely attach movable items or keep in a closed and locked position until glazing compound has thoroughly set.

#### 3.3 GLASS SETTING

Items to be glazed shall be either shop or field glazed using glass of the quality and thickness specified. Preparation and glazing shall conform to applicable recommendations in the **GANA Glazing Manual** and **GANA Sealant Manual**. Handle and install glazing materials in accordance

with manufacturer's instructions. Use beads or stops furnished with items to be glazed to secure glass in place.

#### 3.3.1 Wire Glass

Install glass for fire doors in accordance with installation requirements of **NFPA 80**.

#### 3.3.2 Plastic Sheet

Conform to manufacturer's recommendations for edge clearance, type of sealant and tape, and method of installation.

#### 3.4 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement. Glass shall be clean at the time the work is accepted. [Clean plastic sheet in accordance with manufacturer's instructions.]

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## SECTION 08 88 58

## AIR TRAFFIC CONTROL TOWER CAB GLASS

05/14

## PART 1 GENERAL

## 1.1 SUMMARY

This specification covers engineered tower cab glass for use in military air traffic control towers. Engineering of the tower cab glass is delegated to an approved Glass Engineer. The tower cab glass is used where air traffic is visually controlled and having tower cab glass free of optical distortions or other obstructions that can block or distort vision is critical to air traffic control operations.

## 1.2 DEFINITIONS

## 1.2.1 ATCT

Air Traffic Control Tower

## 1.2.2 Authority Having Jurisdiction (AHJ)

The party that regulates the design and construction process for the project on behalf of the Government.

## [1.2.3 Deterioration of Coated Glass

Defects developed from normal use and weather conditions that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to fabricator's directions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

## ]1.2.4 Deterioration of Glass

Defects developed from normal use and weather conditions that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning glass contrary to fabricator's directions. Defects include glass found to be out of compliance with [ASTM C1036](#).

## [1.2.5 Deterioration of Insulating Glass

Failure includes, but is not limited to, failure of the hermetic seal under normal use and weather conditions due to causes other than glass breakage and improper practices for maintaining and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, film, or minerals on the surfaces of insulated glass facing the interspace or optical distortions (ghosting or double-images) not due to improper practices for maintaining and cleaning glass not in compliance with the manufacturer's or fabricator's directions.

## ]1.2.6 Deterioration of Laminated Glass

Defects developed from normal use and weather conditions that are

attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's or fabricator's directions. Defects include edge separation, delamination, materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.

#### 1.2.7 Designer of Record (DOR)

Architect or Engineer planning and designing the building and site and preparing the contract documents on behalf of the Government.

#### 1.2.8 Fabricator

Where used in this Section to refer to a firm that fabricates glass units as defined in the referenced glazing standards.

#### 1.2.9 Glass Thickness

Nominal glass thickness indicated by thickness designation per glass ply according to [ASTM C1036](#).

##### [1.2.10 Interspace

Air- or inert gas-filled space between lites of an insulating-glass unit.

##### ]1.2.11 Manufacturer

Where used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

#### 1.2.12 Tower Cab Glass

Air traffic control tower cab glass as indicated on the Drawings.

### 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

[ANSI Z97.1](#) (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

#### ASTM INTERNATIONAL (ASTM)

[ASTM C509](#) (2006; R 2021) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material

[ASTM C920](#) (2018) Standard Specification for Elastomeric Joint Sealants

[ASTM C1036](#) (2021) Standard Specification for Flat Glass

[ASTM C1087](#) (2016) Standard Test Method for



	Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
ASTM C1172	(2019) Standard Specification for Laminated Architectural Flat Glass
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D2287	(2019) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM E2129	(2018) Standard Practice for Data Collection for Sustainability Assessment of Building Products
ASTM E2190	(2010) Standard Specification for Insulating Glass Unit Performance and Evaluation
ASTM E2461	(2012; R 2017) Standard Practice for Determining the Thickness of Glass in Airport Traffic Control Tower Cabs
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass
ASTM F2912	(2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings
GLASS ASSOCIATION OF NORTH AMERICA (GANA)	
GANA Glazing Manual	(2008) Glazing Manual
GANA Laminate Manual	(2009) Laminated Glazing Reference Manual

GANA Sealant Manual	(2008) Sealant Manual
INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)	
IGMA TB-3001	(2001) Guidelines for Sloped Glazing
IGMA TM-3000	(1990; R 2016) North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
16 CFR 1201	Safety Standard for Architectural Glazing Materials

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Tower Cab Glass; G[, [\_\_\_\_]]

Submittals which graphically show complete details of the proposed setting methods, mullion details, edge blocking, dimension of glass, dimension of openings, frame details and materials, and types of thickness of glass, coatings, coating position, laminates, and other aspects of the work.

##### SD-03 Product Data

- [ Laminated Annealed Glass; G[, [\_\_\_\_]]
- ][ Low-E Coated Laminated Annealed Glass; G[, [\_\_\_\_]]
- ][ Insulated Laminated Annealed Glass Units; G[, [\_\_\_\_]]
- ][ Low-E Coated Insulated Laminated Annealed Glass Units; G[, [\_\_\_\_]]
- ] Setting and Sealing Materials; G[, [\_\_\_\_]]
- Glazing Accessories; G[, [\_\_\_\_]]

Submit manufacturer of the glass lites and the fabricator of the insulating units. Submit descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions from both the manufacturer of the glass lites and the fabricator of the insulating and laminated units.

- [ Product Data for IEQ credit: For field-applied glazing sealants - documentation including declaration of VOC content.

##### ] SD-04 Samples

- [ Laminated Annealed Glass; G[, [\_\_\_\_\_]]
  - ][ Low-E Coated Laminated Annealed Glass; G[, [\_\_\_\_\_]]
  - ][ Insulated Laminated Annealed Glass Units; G[, [\_\_\_\_\_]]
  - ][ Low-E Coated Insulated Laminated Annealed Glass Units; G[, [\_\_\_\_\_]]
  - ] Setting and Sealing Materials including color; G[, [\_\_\_\_\_]]
  - Glazing Accessories; G[, [\_\_\_\_\_]]
- Provide [three][\_\_\_\_\_] 12 inch by 12 inch samples of tower cab glass units.

#### SD-05 Design Data

##### Cab Glazing Design Analysis; G[, [\_\_\_\_\_]]

Submit design analysis with glass engineering calculations showing that the design of each size and type of glass unit and its attachment to the glazing framing system and surrounding structure conform to project requirements. Indicate the structural performance of each glass unit proposed for use under the given loads as prepared and signed by an approved glass engineer. The size, composition of the glazing units, and details determined by the design analysis must be reflected in the shop drawings of all impacted trades and assemblies.

##### Glass Wind Load Calculations; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

##### Compatibility and Adhesion Test Reports

- [ Standard Airblast Test

#### SD-07 Certificates

##### Glass Engineer Qualifications

##### Fabricator Qualifications

- [ Insulating Glass Certification

- ] Installer Qualifications

##### Product Certificates

- [ Local/Regional Materials

- ][ Environmental Data

- ][ Product Certificates for MR credit: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered

regional.

] SD-10 Operation and Maintenance Data

Maintenance Manuals

[ Warranty for Insulating Glass Products

] [ Warranty for Laminated Glass Products

] [ Warranty for Coated-Glass Products

] 1.5 SYSTEM PERFORMANCE REQUIREMENTS

Provide glazing systems that are engineered, produced, fabricated, and installed to withstand normal thermal movement, [ and] wind loading[, and impact loading] without failure including loss of glass or glass breakage attributable to the following: defective manufacture, fabrication, and installation, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, visual distortion, blockage of vision, and other defects impacting use or performance. [ Provide glazing systems that conform to antiterrorism protection blast pressure and design method or air blast test indicated.]

Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss expected for the service life of the tower.

Temperature Change (Range): [ 120 degrees F] [\_\_\_\_], ambient; [ 180 degrees F] [\_\_\_\_], material surfaces.

Design, engineering, fabrication, and installation must comply with all applicable requirements.

1.6 QUALITY ASSURANCE

1.6.1 Glass Engineer Qualifications

Glass Engineer must be a registered professional engineer in [a U.S. state or territory] [\_\_\_\_] experienced in the design of glass who has successfully completed a minimum of [five] [\_\_\_\_] air traffic control tower cab glass projects and possesses no less than [five] [\_\_\_\_] years of experience with similar projects in nature, size, and extent to this air traffic control tower; being familiar with special requirements indicated; and having complied with requirements of the AHJ.

1.6.2 Fabricator Qualifications

Provide qualifications for fabricators for glass units who have successfully completed a minimum of five air traffic control tower cab glass projects similar in nature, size, and extent to this air traffic control tower including successful in-service performance[ and is a qualified insulating glass fabricator who is approved and certified by the [coated ]glass manufacturer].

[1.6.3 Insulating Glass Certification Program

Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency:

- a. Insulating Glass Certification Council (IGCC).
- b. Associated Laboratories, Inc. (ALI).
- c. National Certified Testing Laboratories (NCTL).

#### ]1.6.4 [Installer Qualifications](#)

Engage an experienced installer who has installed similar glazing assemblies in material, design, and extent to the indicated for this Project with a record of successful in-service performance. Installer must be certified under the National Glass Association's certified glass installer program as level Y2 (Senior Glaziers) or level Y3 (Master Glazier). Equivalent or better certification may be considered if acceptable to the Contracting Officer.

#### 1.6.5 [Single-Source Responsibility](#)

Obtain all tower cab glass from one source. Obtain glazing accessories from one source for each product and installation method indicated.

#### 1.6.6 [Product Certificates](#)

Signed by glazing materials manufacturers certifying that their products comply with specified requirements. Submit certificates to indicate that materials meet specified requirements. Permanent marking safety glass approval on glass lower corner exposed to view is required unless that requirement is waived by the AHJ.

#### 1.6.7 [Glazing Accessories](#)

Submit certificates from the manufacturers attesting that the accessories meet the project requirements including requirements set by the glass engineer designing the glass and supports.

Provide [compatibility and adhesion test reports](#) from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

#### 1.6.8 [Setting and Sealing Materials](#)

[ASTM C1087](#). Submit data from the manufacturer attesting that the sealant used in glazing is compatible with the laminated glass interlayer or primary and secondary sealants in insulated units where applicable. Provide [compatibility and adhesion test reports](#) from sealant manufacturer; indicating that glazing materials were tested for compatibility and adhesion with glazing sealant. Include sealant manufacturer's test results relative to sealant performance and recommendations for primers and substrate preparation required for adhesion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers labeled plainly with manufacturers' names and brands.

Tower cab glass must be boxed, crated, and shipped to the site in a vertical position or as directed by the fabricator. The tower cab glass must be stored in a vertical position against a sturdy support at an angle of approximately 7 degrees from vertical or as directed by the fabricator.

For insulating glass units that will be exposed to substantial altitude changes between location of fabrication and project site or in transit to project site, comply with insulating-glass manufacturer's written recommendations for preventing hermetic seal ruptures at any point or bowing inward or outward of glazing lites when installed due to pressure differentials between interspace air or gas pressure and ambient air pressure at project location.

Tower cab glass and setting materials must be stored in a safe, dry location with adequate ventilation free from heavy dust and must permit easy access for inspection and handling. Unpack glass at time of installation, or as directed by Contracting Officer.

Unpack glass from the front of the case or container and avoid sliding the glass against itself or any un-cushioned materials. Stack individual lites on edge using clean, cushioned pads placed at the quarter points of the bottom edge. Protect all edges from impact and use a clean dry separating materials.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 degrees F.

#### 1.9 SUSTAINABLE DESIGN REQUIREMENTS

##### [1.9.1 Local/Regional Materials

[Regional Materials: Materials must be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as fabricated, within 500 miles of Project site, if available from a minimum of [three] [\_\_\_\_\_] sources.] [ See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total local material requirements. Glazing materials may be locally available.]

##### ]1.9.2 Sealants VOC Content

Field-applied sealants must have a VOC content of not more than 250 g/L[ or lower as required to meet LEED IAQ limits].

##### [1.9.3 Environmental Data

Submit Table 1 of ASTM E2129 for sealants.

##### ]1.10 WARRANTY

Provide 10-year manufacturer's or, where applicable, fabricator's warranty

for tower cab glass.

[1.10.1 [Warranty for Insulating-Glass Products](#)

Provide warranty signed by the [manufacturer][ or ][fabricator] of insulating-glass units agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" article for Deterioration of Insulating Glass, FOB point of manufacture, freight allowed project site, within 10-years after date of Final Acceptance. Warranty covers only deterioration due to normal conditions of use as defined and not due to handling and installing.

] [1.10.2 [Warranty for Laminated-Glass Products](#)

Provide warranty signed by glass the [manufacturer][ or ][fabricator] of laminated-glass agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" article for Deterioration of Laminated Glass, FOB point of manufacture, freight allowed project site, within 10-years after date of Final Acceptance. Warranty covers only deterioration due to normal conditions of use as defined and not due to handling and installing.

] [1.10.3 [Warranty for Coated-Glass Products](#)

Provide warranty signed by coated-glass units the [manufacturer][ or ][fabricator] agreeing to replace coated-glass units that deteriorate as defined in definitions article for Deterioration of Coated Glass, FOB point of manufacture, freight allowed project site, within 10-years after date of Final Acceptance. Warranty covers only deterioration due to normal conditions of use as defined and not due to handling and installing.

] PART 2 PRODUCTS

2.1 SYSTEM DESIGN REQUIREMENTS

2.1.1 [Cab Glazing Design Analysis](#)

Engage a qualified Glass Engineer to design glazing system as a delegated design. Installed glazing system must withstand normal thermal movement and wind[ and][ impact][ and air blast] loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.[ Delegated design must include antiterrorism protection requirements.]

2.1.2 Structural Performance

Submit signed and sealed [glass wind load calculations](#) by the Glass Engineer for all glass installations certifying compliance with wind load[ and impact load] requirements below, and as indicated on the drawings[ as well as antiterrorism protection blast loads and design methods specified]. The thickness of glass and support requirements must be determined using the most stringent requirements of both [ASTM E1300](#) and [ASTM E2461](#).

[ For insulating glass units that will be exposed to substantial altitude changes after fabrication, engineer insulated glass unit lites to maintain parallel alignment to avoid optical distortions (ghosting /double images) when viewing through glass.

]

- a. Design Wind Pressure: As indicated on the Drawings.
- b. Maximum Lateral Deflection: Tower cab glass is supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than  $[1/50]$   $[_____]$  times the short-side length or 1 inch, whichever is less.

### 2.1.3 Thermal Performance

Glazing must be designed in response to full calendar year project site climatic conditions and sun angles in coordination with tower cab mechanical systems assuring that maximum visibility is afforded while thermal effects that could overwhelm mechanical systems or cause condensation on interior or exterior surfaces of the glass are prevented.

### [2.1.4 Antiterrorism Performance

Minimum Antiterrorism Performance - Glazing must meet the minimum antiterrorism performance criteria specified in the paragraphs below. Conformance to the performance requirements must be validated by [ one of ] the following method[s].

- [ a. Computational Design Analysis Method - Cab glazing must be designed to the criteria listed herein. Computational design analysis must include calculations verifying the structural performance of each glazing unit proposed for use, under the given static equivalent loads. Glazing resistance must be greater than equivalent 3-second duration loading of  $[_____]$  pounds per square foot (psf). The glazing frame bite for the cab frames must be in accordance with [ASTM F2248](#). ]
- [ b. Dynamic Design Analysis Method - Cab glazing must be designed using a dynamic analysis to prove the glazing will provide performance equivalent to or better than a [low][very low] hazard rating in accordance with [ASTM F2912](#) associated with the applicable [very low] [low level] of protection for the peak positive pressure of  $[_____]$  pounds per square foot (psf) and positive phase impulse of  $[_____]$  pounds per square inch - millisecond (psi-msec). The allowable response limits of aluminum frame elements for low level of protection requirements are as follows: Maximum ductility ratio of  $[_____]$  and maximum support rotation of  $[_____]$  degrees. ]
- [ c. [Standard Airblast Test](#) Method - As an alternative to 'Dynamic Design Analysis Method' indicated above, glazing may be tested for evaluation of hazards generated from airblast loading in accordance with [ASTM F1642/F1642M](#) by an independent testing agency regularly engaged in blast testing. For proposed glazing systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed glazing size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems. Proposed glazing of a size outside this range must require testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. The test must be performed on the entire proposed glazing system, which must include, but not be limited to, the glazing, its framing/support system, operating devices, and all anchorage devices. Anchorage of the glazing support system must replicate the method of installation to be used for the project. The minimum airblast loading parameters for the test must be as follows: peak positive pressure of  $[_____]$  pounds per square inch ]



(psi) and positive phase impulse of [\_\_\_\_\_] pounds per square inch - millisecond (psi-msec). The hazard rating for the proposed glazing systems, as determined by the rating criteria of ASTM F1642/F1642M, to provide performance equivalent to or better than a [low] [very low] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard" and "Very Low Hazard" ratings are acceptable. "Low Hazard" and "High Hazard" ratings are unacceptable) associated with the applicable [very low] [low level] of protection. Results of glazing systems previously tested by test protocols other than ASTM F2912 may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

#### ]]2.1.5 Windborne-Debris-Impact Performance

Exterior glazing must comply with indicated basic or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

a. Refer to drawings for classification of tower cab requiring basic or enhanced protection.

[ b. Large-Missile Test: For glazing located within 30 feet of grade.

]c. Small-Missile Test: For glazing located more than 30 feet above grade.

#### ]]2.1.6 Tower Cab Glass Location and Sizes

Refer to Drawings for location, size intent, and geometry of tower cab glass units.

#### 2.1.7 Tower Cab Glass Slope

Provide outward slope indicated on the drawings for tower cab glass.

### 2.2 GLASS MATERIALS

Tower cab glass thicknesses shown on the Drawings or specified herein are minimums. Manufacturer must certify that glass can withstand all forces specified.

a. The thickness of the tower cab glass must be determined the Glass Engineer complying with ASTM E2461 for a probability of breakage of 1 lite per 1000.

b. No on-site grinding or buffing of the glass is allowed. Glass edges must be clean cut, undamaged, and flat ground.

c. Probability of Breakage for Sloped Glazing: For glass surfaces sloped from vertical, the thickness of the tower cab glass must be determined by ASTM E2461 for a probability of breakage not greater than 1 lite per 1000 at the first occurrence of the design wind loading.

d. Glass subject to accidental human impact must be glazed with laminated safety glass in accordance with 16 CFR 1201 and ANSI Z97.1.

#### 2.2.1 Annealed Glass

Low-iron annealed float glass must be [ASTM C1036](#), Type I, Class I (Clear), quality q3; and with visible light transmission of not less than 91 percent and solar heat gain coefficient of not less than 0.90 for 1/4 inch thickness with the following quantities:

- a. Allowable scratches: None.

#### [2.2.2 Insulated Glass

Insulating-glass components must be as required to factory-assemble glass units with hermetically sealed dehydrated interspace, qualified according to [ASTM E2190](#).

- a. Sealing System: Units must be double sealed. Primary seal must be polyisobutylene; secondary seal must be silicone.
- b. Spacer: Stainless steel.
- c. Desiccant: Molecular sieve or silica gel, or a blend of both.

#### ] [2.2.3 Laminated Glass Interlayers

Laminated glass must comply with the [GANA Laminate Manual](#) and interlayer must comply with [ASTM C1172](#). Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

- a. Interlayer Material: [Polyvinyl butyral (PVB) interlayer] [Ionomeric polymer interlayer] [ or ] [Cast-in-place and cured-transparent-resin interlayer] used in compliance with the interlayer manufacturer's written instructions.
- b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with engineered requirements.
- c. Interlayer Color: Clear.

#### ] [2.2.4 Interspace

The inner and outer lites of insulated glass units must be separated by a 1/2-inch minimum hermetically sealed interspace. The entrapped air or gas must be dehydrated by a drying agent. Tower cab glass must be fabricated for use at the installation's elevation above mean sea level (AMSL). Units must be free of any optical distortion at the time of installation.

#### ] 2.3 TOWER CAB GLASS ASSEMBLIES

Tolerances and clearances for units must be designed to prevent the transfer of stress in metal frames to the glass under all design conditions. Resilient setting blocks, spacer strips, clips, bolts, washers, angles, glazing sealants, and resilient channels must be of the type recommended in the glass manufacturer's approved written instructions.

#### [ 2.3.1 Laminated Annealed Glass Units

Glass Type: Low-iron clear laminated glass with no less than two plies of low-iron annealed float glass.

- a. Overall Unit Thickness: [\_\_\_\_\_] inch minimum.

- b. Minimum Thickness of Each Glass Ply: 1/8 inch.
- c. Interlayer Thickness: 0.060 inch minimum each.

] [2.3.2 Low-E Coated Laminated Annealed Glass Units

Glass Type: Low-iron clear Low-E laminated glass with [two] [\_\_\_\_\_] plies of low-iron annealed float glass.

- a. Overall Unit Thickness: [\_\_\_\_\_] [\_\_\_\_\_] inch minimum.
- b. Minimum Thickness of Each Glass Ply: 1/8 inch.
- c. Interlayer Thickness: 0.060 inch minimum each.
- d. Low-E Performance: [Pyrolytic hard coat on first surface (out of four surfaces total)] [Pyrolytic hard coat on fourth surface (out of four surfaces total)] [Low-E film between two plies of interlayer].
- e. Winter Nighttime U-Factor: [\_\_\_\_\_] maximum.
- f. Summer Daytime U-Factor: [\_\_\_\_\_] maximum.
- g. Visible Light Transmittance: [\_\_\_\_\_] percent minimum.
- h. Solar Heat Gain Coefficient: [\_\_\_\_\_] maximum.

] [2.3.3 Insulated Laminated Annealed Glass Units

Glass Type: Insulating laminated low-iron clear annealed float glass.

- a. Overall Unit Thickness: [\_\_\_\_\_] inch minimum.
- b. Outdoor Lite: Low-iron clear laminated glass with two plies of low-iron annealed float glass.
  - (1) Minimum Thickness of Each Glass Ply: 1/8 inch.
  - (2) Interlayer Thickness: 0.060 inch minimum each.
- c. Interspace Content: [Air] [Argon].
- d. Indoor Lite: Low-iron clear laminated glass with two plies of low-iron annealed float glass
  - (1) Minimum Thickness of Each Glass Ply: 1/8 inch.
  - (2) Interlayer Thickness: 0.060 inch minimum each.
- e. Winter Nighttime U-Factor: [\_\_\_\_\_] maximum.
- f. Summer Daytime U-Factor: [\_\_\_\_\_] maximum.
- g. Visible Light Transmittance: [\_\_\_\_\_] percent minimum.
- h. Solar Heat Gain Coefficient: [\_\_\_\_\_] maximum.

] [2.3.4 Low-E Coated Insulated Laminated Annealed Glass Units

Glass Type: Insulating laminated Low-E coated low-iron clear annealed float glass.

- a. Overall Unit Thickness: [\_\_\_\_\_] inch minimum.
- b. Outdoor Lite: Low-iron clear laminated glass with two plies of low-iron annealed float glass.
  - (1) Minimum Thickness of Each Glass Ply: 1/8 inch.
  - (2) Interlayer Thickness: 0.060 inch minimum each.
- c. Interspace Content: [Air] [Argon].
- d. Low-E Coating: [Pyrolytic on fourth] [Pyrolytic on fifth] [Sputtered on fourth] [Sputtered on fifth] surface (out of eight surfaces total).
- e. Indoor Lite: Low-iron clear laminated glass with two plies of low-iron annealed float glass
  - (1) Minimum Thickness of Each Glass Ply: 1/8 inch.
  - (2) Interlayer Thickness: 0.060 inch minimum each.
- f. Winter Nighttime U-Factor: [\_\_\_\_\_] maximum.
- g. Summer Daytime U-Factor: [\_\_\_\_\_] maximum.
- h. Visible Light Transmittance: [\_\_\_\_\_] percent minimum.
- i. Solar Heat Gain Coefficient: [\_\_\_\_\_] maximum.

#### ]2.4 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, [IGMA TM-3000](#), [IGMA TB-3001](#), and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted must be a dark color to match mullions.

##### 2.4.1 Elastomeric Sealant

[ASTM C920](#), Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing sash. Sealant must be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units. For laminated glass the sealant must be compatible with interlayer. Sealant color must be as selected from manufacturer's samples.

##### 2.4.2 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the project specific conditions.

##### 2.4.3 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with [ASTM D2287](#). Use sealing tape

only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes must be chemically compatible with the product being set.

#### 2.4.4 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks must be dense extruded type conforming to [ASTM C509](#) and [ASTM D395](#), Method B, Shore A durometer of 90. Profiles, lengths and locations must be as required and recommended in writing by glass manufacturer. Block color must be black.

#### 2.4.5 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing must be permanent, elastic, non-shrinking, non-migrating, water tight, and weather tight.

#### 2.4.6 Glazing Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide anticorrosion metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

### 2.5 FABRICATION

Provide glazing units required to fit glazing opening sizes and shapes and outward slope indicated on the construction documents and as verified in the field with edge and face clearances, edge and surface conditions, and bite complying with written instructions manufacturer, fabricator and referenced glazing publications, to comply with system performance requirements.

## PART 3 EXECUTION

### 3.1 GLAZING, GENERAL

Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

Install tower cab glass at outward slope indicated on the drawings.

Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

Protect glass from edge damage during handling and installation as follows:

- a. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
- b. Remove damaged glass from Project site and legally dispose of off site.

Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass as follows:

- a. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
- b. Provide manufacturer's recommended minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer. Prevent shifting of glass units within the mullion rabbets which could cause loss of required bite.

### 3.2 PREPARATION

Preparation, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

[ Where tower cab glass mullions also structurally support the tower cab roof and penthouse, the full dead load of the tower cab roof, not including the tower cab ceiling grid and panels, must be applied before taking final measurements of the tower cab glazing openings. The tower cab glass must then be fabricated to fit those actual dimensions.

] Inspect glazing units to locate exterior and interior surfaces. Temporarily label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not specified as permanently bonded to substrates.

Ensure that glazing framing weep system must not be obstructed during

installation of glazing. Coordinate installation with glazing frame manufacturer's instructions, and requirements.

### 3.3 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

#### 3.3.1 Manufacturer's Instructions

Comply with the manufacturer's warranty and written instructions. Confirm that additional specified requirements are accepted by the manufacturer in writing. Secure glass in place with bolts and spring clips. The minimum clearance between bolts and edge of glass unit must be  $3/16$  inch. The glass must be edged, top and bottom, with  $3/16$  inch thick continuous neoprene, vinyl, or other approved material. Trim edging after installation. The channel shapes or strips must be firmly held against the glass by the spring action of the extruded metal moldings or metal bars. Resilient setting blocks, spacer strips, clips, bolts, washers, angles, applicable glazing compound, and resilient channels or cemented-on materials must be as recommended in the written instructions of the glass manufacturer which must be submitted and approved prior to shipping the tower cab glass.

#### 3.3.2 Tolerances and Clearances of Units

Design to prevent the transfer of stress in the setting frames to the glass. Springing, twisting, or forcing of units during setting is not permitted.

#### [3.3.3 Insulating Glass Units

Springing, forcing, or twisting of units during setting is not permitted. Handle units so as not to strike frames or other objects. Installation must conform to applicable recommendations of [IGMA TB-3001](#) and [IGMA TM-3000](#).

#### ]3.3.4 Seismic Installation

Comply with the following requirements for seismic installation.

- a. Glass Corner and Edge Cushioning: Padding consisting of 50-70 shore durometer hardness material should be placed in the glazing channel or on the glass edges/corners to avoid any glass to frame contact.
- b. Gasket Performance: Gasket should have a positive lock-in method so that gasket will not disengage from metal framing system during up and down and side-to-side movement.
- c. Setting Blocks and Supports: Permanently mount setting block and supports to frame using a compatible sealant. Use anti-walk blocks.

#### ]3.3.5 Laminated Glass Units

Frames which are to receive laminated glass must be weeped to the outside to prevent water collection in channels or rabbets.

### 3.4 CLEANING

Follow recommendations of [GANA Glazing Manual](#) and the glass manufacturer. Clean glass and metal frequently during construction. Clean glass surfaces and remove labels, paint spots, and other defacement as required to prevent staining. Glass must be cleaned with a soft, clean, grit-free cloth, mild soap, detergent, or slightly acidic cleaning solution. Rinse immediately after cleaning with water and promptly remove excess rinse water with a clean squeegee. Razor blades or other sharp objects must not be used to clean glass surfaces. Glass must be clean at the time the Work is accepted.

#### 3.4.1 Cleaning Prior to Final Inspection

Clean glass at least one day prior to final inspection. Final inspection will be performed during the day and at night. Inspection at night is required verifying that the glass does not have optical distortions that causes ghosting/double images. No additional work will be performed in tower cab by the contractor after final inspection without permission of contracting officer.

### 3.5 PROTECTION

Glass work must be protected immediately after installation. Glazed openings must be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Protective material must be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities must be removed and replaced with new units.

Follow recommendations of [GANA Glazing Manual](#) and the glass manufacturer. Protect the glass from weld splatter by using plywood or heavy tarpaulins. Do not place insulation over the glass for protection or keep shading material on the glass because excess thermal buildup could result in glass breakage. Do not allow materials to be stored or placed in contact with the glass.

### 3.6 WASTE MANAGEMENT

Disposal and recycling of waste materials, including corrugated cardboard recycling, must be in accordance with the Waste Management Plan. Close and seal tightly all partly used sealant containers and store protected in well-ventilated, fire-safe area at moderate temperature.

### 3.7 MAINTENANCE MANUALS

Provide product manufacturer's published and written instructions for both the maintenance and cleaning of the tower cab glass assemblies as installed in the format compliant with the project requirements and as approved by the Contracting Officer.

-- End of Section --



## SECTION 08 91 00

## METAL [WALL] [AND] [DOOR] LOUVERS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

- AMCA 500-L (2015) Laboratory Methods of Testing Louvers for Rating
- AMCA 511 (2010; R 2016) Certified Ratings Program for Air Control Devices

## ALUMINUM ASSOCIATION (AA)

- AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 611 (2014) Voluntary Specification for Anodized Architectural Aluminum
- AAMA 2603 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
- AAMA 2605 (2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

## ASTM INTERNATIONAL (ASTM)

- ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM A780/A780M (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- ASTM A1008/A1008M (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural,

High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM B209

(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221

(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Wall Louvers

### SD-03 Product Data

Metal Wall Louvers

Door Louvers

### SD-04 Samples

Wall Louver Samples; G[, [\_\_\_\_]]

Door Louver Samples; G[, [\_\_\_\_]]

## 1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers must be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

## 1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

## 1.5 COLOR SAMPLES

Colors of finishes for wall louver samples and door louver samples must closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Galvanized Steel Sheet

ASTM A653/A653M, coating designation G90.

#### 2.1.2 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

#### 2.1.3 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

#### [2.1.4 Stainless Steel

Type 302 or 304, with 2B finish.

#### ]2.1.5 Cold Rolled Steel Sheet

ASTM A1008/A1008M, Class 1, with matte finish. Use for interior louvers only.

### 2.2 METAL WALL LOUVERS

[Weather] [Wind driven rain] resistant type, with bird screens and made to withstand a wind load of not less than [30] [\_\_\_\_\_] pounds per square foot. Wall louvers must bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-L and AMCA 511. The rating must show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.

#### 2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

#### 2.2.2 Formed Metal Louvers

Formed of [zinc-coated] [stainless] steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 0.08 inch thick.

#### 2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions [where indicated] [for all louvers more than 5 feet in width at not more than 5 feet on centers]. Provide mullion covers on both faces of joints between louvers.

#### 2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. For steel louvers, provide 1/2 inch square mesh, 12 or 16 gage zinc-coated steel; 1/2 inch square mesh, 16 gage copper; or 1/4 inch square mesh, 16 gage zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

### 2.3 DOOR LOUVERS

[Inverted "Y"] [ or ] [Inverted "V"] sightproof type not less than one inch thick with matching metal trim. Louvers for exterior doors must be weather resistant type.

### 2.3.1 Extruded Aluminum Door Louvers

Fabricate of 6063-T5 or -T52 aluminum alloy with a wall thickness of not less than 0.050 inch thick. Frames and trim must be clamp-in "L" type.

### 2.3.2 Formed Metal Door Louvers

Fabricate of [ 20 U.S. gage steel sheet][ or ][sheet aluminum not less than 0.050 inch thick]. Trim must be beveled "Z" molding both sides.

### 2.3.3 Screens and Frames

For exterior doors, provide aluminum insect screens, 18 by 16 or 18 by 14 mesh. Mount screens in removable, rewirable frames of same material and finish as the louvers.

## 2.4 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

## 2.5 FINISHES

### 2.5.1 Aluminum

Exposed aluminum surfaces must be factory finished with an [anodic coating][ or ][organic coating]. [ Color must be [\_\_\_\_\_] [as indicated].] Louvers [for each building] must have the same finish.

#### 2.5.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

- [ a. Architectural Class II ( 0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color] anodized.
- ] [b. Architectural Class I ( 0.7 mil or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.

#### ] 2.5.1.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a [baked enamel finish conforming to AAMA 2603, with total dry film thickness not less than 0.8 mil ] [superior performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 1.2 mil], color [\_\_\_\_\_] .

### 2.5.2 Steel

Surfaces specified must have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating must conform to ASTM A653/A653M, coating designation Z275 (G90) [, except that louvers located in conditioned spaces on interior of the building may be Z180 (G60)]. The weight of zinc coatings must be as designated in Table I of ASTM A123/A123M for the thickness of base metal to be coated. The prime

coat must be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces by the materials and methods conforming to **ASTM A780/A780M** and spot prime. At the option of the Contractor, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel top coat may be applied before forming, in lieu of prime coat specified.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

##### 3.1.2 Door Louvers

Install louvers in wood doors by using metal "Z" or "L" moldings. Fasten moldings to door with screws.

##### 3.1.3 Screens and Frames

Attach frames to louvers with screws or bolts.

#### 3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

##### 3.2.1 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

##### 3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

##### 3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

##### 3.2.4 Wood

Paint wood or other absorptive materials that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

-- End of Section --

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## SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD  
02/10, CHG 2: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

**AISC 341** (2016) Seismic Provisions for Structural Steel Buildings

## ASTM INTERNATIONAL (ASTM)

**ASTM A463/A463M** (2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

**ASTM A653/A653M** (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

**ASTM C645** (2014; E 2015) Nonstructural Steel Framing Members

**ASTM C754** (2020) Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

**ASTM C841** (2003; R 2013) Installation of Interior Lathing and Furring

**ASTM C847** (2014a) Standard Specification for Metal Lath

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

**NAAMM EMLA 920** (2009) Guide Specifications for Metal Lathing and Furring

## UNDERWRITERS LABORATORIES (UL)

**UL Fire Resistance** (2014) Fire Resistance Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will

review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Metal Support Systems; G[, [\_\_\_\_\_]]

Submit for the erection of metal[ framing,][ furring,][ and][ ceiling suspension systems]. Indicate materials, sizes, thicknesses, and fastenings.

#### SD-03 Product Data

##### Metal Support Systems

##### Recycled Content for Metal Support Systems; S

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations permitting easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating.[ Provide support systems and attachments per [AISC 341] [\_\_\_\_\_] [UFC 3-301-01, "Structural Engineering"] in seismic zones.]

Provide metal support systems containing a minimum of 20 percent recycled content. Provide data identifying percentage of recycled content for metal support systems.

#### 2.1.1 Materials for Attachment of Lath

##### 2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, and ASTM C847.

##### 2.1.1.2 Non-load Bearing Wall Framing

NAAMM EMLA 920.

#### 2.1.2 Materials for Attachment of Gypsum Wallboard

##### 2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C645.

##### 2.1.2.2 Non-load Bearing Wall Framing and Furring

ASTM C645, but not thinner than[ 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment



and fixtures] [ 0.0329 inch thickness regardless of the ASTM certified third party testing statement for equivalent thicknesses].

#### 2.1.2.3 Furring Structural Steel Columns

ASTM C645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

#### 2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 26 gage galvanized steel, Z-shaped, with 1-1/4 inch and 3/4 inch flanges and [ [1] [1 1/2] [2] [3] inch furring depth] [depth as required by the insulation thickness provided].

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Systems for Attachment of Lath

###### 3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C841, except as indicated otherwise.

###### 3.1.1.2 Non-load Bearing Wall Framing

NAAMM EMLA 920, except provide framing members 16 inches o.c. unless indicated otherwise.

##### 3.1.2 Systems for Attachment of Gypsum Wallboard

###### 3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C754, except provide framing members 16 inches o.c. unless indicated otherwise.

###### 3.1.2.2 Non-load Bearing Wall Framing and Furring

ASTM C754, except as indicated otherwise.

###### 3.1.2.3 Furring Structural Steel Columns

Install studs or galvanized steel clips and support angles for erection of gypsum wallboard around structural steel columns in accordance with the UL Fire Resistance, design number(s) [indicated] [of the fire resistance rating indicated].

###### 3.1.2.4 Z-Furring Channels with Wall Insulation

Install Z-furring channels vertically spaced not more than 24 inches o.c. Locate Z-furring channels at interior and exterior corners in accordance with manufacturer's printed erection instructions. Fasten furring channels to [ masonry] [ and] [ concrete] walls with powder-driven fasteners or hardened concrete steel nails through narrow flange of channel. Space fasteners not more than 24 inches o.c.

#### 3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/4 inch in 8 feet from a straight line;
- c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/8 inch in 8 feet from a straight line;
- c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

## SECTION 09 23 00

GYPSUM PLASTERING  
08/16, CHG 1: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C28/C28M	(2010) Gypsum Plasters
ASTM C35	(2001; R 2019) Inorganic Aggregates for Use in Gypsum Plaster
ASTM C59/C59M	(2000; R 2020) Standard Specification for Gypsum Casting Plaster and Gypsum Molding Plaster
ASTM C61/C61M	(2000; R 2011) Gypsum Keene's Cement
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C472	(2020) Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete
ASTM C631	(2009; R 2020) Bonding Compounds for Interior Gypsum Plastering
ASTM C842	(2005; R 2021) Standard Specification for Application of Interior Gypsum Plaster
ASTM E1042	(2002; R 2021) Standard Classification for Acoustically Absorptive Materials Applied by Trowel or Spray

## FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>
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## UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2014) Fire Resistance Directory
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in

accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Gypsum Base Coat Plaster

Gypsum Finish Coat Plaster

SD-04 Samples

Sample Panel; G[, [\_\_\_\_\_]]

Submit four 36 inch square panels of varying texture for the Contracting Officer's approval.

Gypsum Plaster Full Size Sample; G[, [\_\_\_\_\_]]

SD-08 Manufacturer's Instructions

Ready-Mix Gypsum Plaster

[ Acoustical Plaster Finish

] Submit manufacturer's printed mixing instructions for ready-mix plaster[ and acoustical plaster finish].

[1.3 QUALITY ASSURANCE

1.3.1 Sample Panels

Erect sample panel at the building site, or as otherwise directed. Finished gypsum plaster work must match the approved sample panel.

]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver manufactured materials in the manufacturers' original unbroken packages or containers which are labeled plainly with the manufacturers' names and brands. Keep cementitious materials dry and stored off the ground, under cover, and away from sweating walls and other damp surfaces until ready for use. Keep materials wrapped and separate from off-gassing materials, such as paints and adhesives. Do not use materials that have visible moisture or biological growth.

1.5 GYPSUM PLASTER FULL SIZE SAMPLE

After selection of an acceptable texture, construct a sample [panel] [wall] separate from the building, minimum size of [8] [\_\_\_\_\_] ft in height, by [8] [\_\_\_\_\_] ft in length, using 6 inch metal studs, and gypsum board, metal lath and gypsum plaster. The sample wall must show all aspects of gypsum plaster work, including but not limited to, expansion joints, control joints, corner extrusions, [ [electrical] [mechanical] [and] [fire sprinkler] penetration[s]] and casing beads. A sample of a control joint and extrusion butt joint must also be incorporated into the sample wall. Finish work must match the approved sample panel. [ Divide the panel into four equal quadrants with the expansion and control joints to show each phase of work, lath, scratch coat, brown coat, and finish coats.] Provide and protect the sample wall from damage during the length of the contract.

1.6 SCHEDULING AND ENVIRONMENTAL REQUIREMENTS

Commence application only after the area scheduled for gypsum plastering work is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the plaster. If the mechanical system cannot be activated before veneer plastering is begun, the plastering may proceed in accordance with an approved plan to maintain the environmental requirements specified below. Apply plaster prior to the installation of finish flooring and acoustic ceiling.

#### 1.6.1 Environmental Requirements

Do not expose the gypsum base to excessive sunlight prior to plaster application, as bond failure of the plaster may result. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of veneer plaster, while the plastering is being done, and for at least one week after the plaster is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during plaster application, set, and until plaster is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Openings can be reduced in cold weather. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following plastering and until plaster is dry.

#### [1.7 FIRE RESISTIVE COATINGS

Comply with specified fire-rated assemblies for design numbers indicated per UL Fire Resistance or FM APP GUIDE.

#### ]PART 2 PRODUCTS

#### 2.1 MATERIALS

Conform to the specifications, standards, and requirements specified herein. Provide asbestos-free materials.

#### 2.2 GYPSUM BASE COAT PLASTER

##### [2.2.1 Gypsum Neat Plaster Base Coat

ASTM C28/C28M.

##### ] [2.2.2 Gypsum Ready-Mixed Plaster Base Coat

ASTM C28/C28M.

##### ] [2.2.3 Gypsum Wood-Fibered Plaster Base Coat

ASTM C28/C28M.

##### ] [2.2.4 High Strength Gypsum Plaster Base Coat

ASTM C28/C28M, gypsum neat plaster, except plaster must have a compressive strength of not less than 2,500 psi, when tested dry in accordance with

ASTM C472.

]2.3 GYPSUM FINISH COAT PLASTER

[2.3.1 Gypsum Gauging Plaster Finish Coat

ASTM C28/C28M.

] [2.3.2 High Strength Gypsum Gauging Plaster Finish Coat

ASTM C28/C28M, gypsum gauging plaster, except plaster must have a compressive strength of not less than 4,500 psi when tested dry in accordance with ASTM C472.

] [2.3.3 Gypsum Molding Plaster for Ornamental Plaster

ASTM C59/C59M.

] [2.3.4 Keene's Cement Finish Coat

ASTM C61/C61M.

] [2.3.5 Acoustical Plaster Finish Coat

ASTM E1042 Type [I,] [II,] Class A, noncombustible.

]2.4 HYDRATED LIME

ASTM C206, Type S.

2.5 AGGREGATES

2.5.1 Sand for Gypsum Base Coats

ASTM C35.

Sand Gradation: Percentage retained by weight (plus or minus 2 percent) on each sieve.

	<u>Sieve Size</u>	<u>Maximum</u>	<u>Minimum</u>
No. 4	[4760 microns]	0	0
No. 8	[2380 microns]	5	0
No. 16	[1190 microns]	30	5
No. 30	[ 590 microns]	65	30
No. 50	[ 300 microns]	95	65
No. 100	[ 150 microns]	100	90

2.5.2 Sand for Gypsum Sand Float Finish

ASTM C842.

Sand Gradation: Percentage retained by weight (plus or minus 2

percent) on each sieve.

<u>Sieve Size</u>			<u>Maximum</u>	<u>Minimum</u>
No. 20	[850 microns]		0	
No. 30	[590 microns]		0.5	
No. 100	[150 microns]		100	40
No. 200	[ 75 microns]		100	70

### 2.5.3 Lightweight Aggregates, Perlite or Vermiculite for Gypsum Base Coat

ASTM C35.

### 2.5.4 Silica Sand or Perlite Fines

For use in lime-putty gypsum-gauged finish, aggregated white coat, must have the following gradation: 10 percent maximum retained on a No. 30 sieve, 4 percent minimum and 70 percent maximum retained on a No. 100 sieve, and 70 percent minimum and 100 percent maximum retained on No. 200 sieve.

### 2.6 WATER

Use only potable water, free of mineral and organic substances that affect the hardening and durability of the plaster or stucco.

### 2.7 PROPORTIONING

Unless specified otherwise, materials are specified on a volume basis and must be measured in approved containers, to ensure that the specified proportions will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels (shovel count) is not be permitted. Prepare [ready-mix gypsum plaster](#) for use by the addition of water only.

#### 2.7.1 Gypsum Base Coat Plaster

Use of sand or lightweight aggregate is optional in gypsum plaster basecoats, except provide (1) sand for Keene's cement and high strength gypsum-gauged finish coats; (2) lightweight aggregate when necessary for a required fire resistance rating [; and (3) [\_\_\_\_\_]].

##### 2.7.1.1 Sand and Gypsum Plaster Base Coat

Mix scratch coat in the proportion of 100 lb of gypsum neat plaster to not more than 2 cu ft of damp loose sand; mix brown coat in the proportion of 100 lb of gypsum neat plaster to not more than 3 cu ft of damp loose sand; or scratch and brown coats may both be mixed in the proportion of 100 lb of gypsum neat plaster to not more than 2-1/2 cubic feet of damp loose sand. [ Mix the basecoats for double-up work in the proportion of 100 lb of gypsum neat plaster to [ not more than 2-1/2 cu ft of damp loose sand on gypsum lath] [ and] [ not more than 3 cu ft of damp loose sand on masonry]. ]

##### 2.7.1.2 Lightweight Aggregate and Gypsum Plaster Base Coat

Mix scratch coat in the proportion of 100 lb of gypsum neat plaster to [ not more than 2-1/2 cu ft of lightweight aggregate on gypsum lath,] [ and] [ not

more than 3 cu ft of lightweight aggregate on masonry]. Mix brown coat in the proportion of 100 lb of gypsum neat plaster to [ not more than 2-1/2 cu ft of lightweight aggregate on gypsum lath] [ and] [ not more than 3 cu ft of light weight aggregate on masonry]. Where plaster thickness exceeds one inch, the aggregate proportion may be increased to 3 cu ft. [Mix the basecoats in two-coat double-up work in the proportion of 100 lb of gypsum neat plaster to [ not more than 2-1/2 cu ft of lightweight aggregate on gypsum lath] [ and] [ not more than 3 cu ft of lightweight aggregate on masonry]]. Gypsum ready-mixed plaster with perlite aggregate may be provided in lieu of field-mixed lightweight aggregate and gypsum plaster, provided the specified proportion of aggregate to plaster does not exceed the proportion specified for field-mixed plaster.

#### 2.7.1.3 Sand and Wood Fibered Gypsum Plaster Base Coat

Mix basecoats in the proportion of 100 lb of wood-fibered gypsum plaster to not more than one cu ft of damp loose sand.

#### 2.7.1.4 Sand and High-Strength Gypsum Plaster Base Coat

Mix scratch coat in the proportion of 100 lb of high strength gypsum base coat plaster to not more than 2 cu ft of damp loose sand. Mix brown coat in the proportion of 100 lb of high strength gypsum basecoat plaster to not more than 3 cu ft of damp loose sand.

#### 2.7.2 Gypsum Plaster Finish Coat

##### 2.7.2.1 Lime-Putty

Prepare lime-putty in accordance with the printed directions of the manufacturer. Use putty following preparation or following a soaking period as recommended by the manufacturer.

##### 2.7.2.2 Lime-Putty Gypsum-Gauged (White Coat)

Use over [ sand and gypsum plaster] [ sand and wood-fibered gypsum plaster]. Mix finish coat in the proportions of one part of gypsum gauging plaster to a volume of hydrated lime or lime putty.

This mix is approximately equivalent to one 100 lb bag of gypsum gauging plaster to:

- a. Not more than four 50 lb bags of hydrated lime, or
- b. Not more than 4-1/2 cu ft of lime putty, or
- c. Not more than 35 gal of lime putty.

##### 2.7.2.3 Aggregated Finish Coat

Finish coat must consist of the lime-putty, gypsum-gauged finish specified herein with the addition of fine pulverized silica sand or perlite fines in the following proportions:

- a. 1/2 cu ft per 100 lb bag of gypsum gauging plaster used in finish, or
- b. 1/8 cu ft per 50 lb bag of hydrated lime, or
- c. one gal per cu ft of lime-putty.



#### 2.7.2.4 Gypsum Sand Float Finish[ for [\_\_\_\_]]:

Mix finish in the proportion of one part neat unfibered gypsum plaster to not more than two parts of sand, by weight.

#### 2.7.2.5 Keene's Cement Lime-Putty Finish[ for [\_\_\_\_]]

Mix finish in the proportion of not more than 100 lb of lime putty to 100 lb of Keene's cement.

#### 2.7.2.6 High Strength Gypsum-Gauged Plaster Finish[ for [\_\_\_\_]]

Mix finish in the proportion of 200 lb of high strength gauging to 100 lb of hydrated lime.

#### 2.7.2.7 Acoustical Plaster Finish[ for [\_\_\_\_]]

Mix finish in accordance with manufacturer's printed instructions.

### 2.8 MIXING

#### 2.8.1 Job-Mixed Materials

Mix materials in mechanical mixers except finish coats containing lime may be hand mixed. Mechanical mixers must be an approved type that accurately and uniformly controls the quantity of water. When mixing by hand, mix dry plaster aggregate to a uniform color in the mixing box, add water, and hoe the plaster immediately into the water and mix thoroughly to a proper consistency.

##### 2.8.1.1 Water

Water used for rinsing and cleaning containers and tools must not be used in mixing the materials.

##### 2.8.1.2 Sand

Sand proportions must be damp and in loose condition. A volume of damp loose sand must contain a minimum of 80 lb of dry sand in one cu ft.

##### 2.8.1.3 Mixing (Do's)

Mix the material while the mixer is in continuous operation in the following sequence:

- a. Add maximum close to 90 percent of estimated quantity of water.
- b. Add approximately one-half of the sand. If vermiculite or perlite is used, add all the aggregate.
- c. Add cement and approved admixtures. [Add lime prior to cement.]
- d. Add remainder of sand.
- e. Mix with remainder of water as required. Mix until the mixture is uniform in color and consistency.

##### 2.8.1.4 Mixing (Don'ts)

Avoid excessive mixing and agitation. Discard gypsum plaster which has begun to set before it is used; do not permit retempering. Do not use frozen, caked, or lumped materials. Empty mixers and mixing boxes after each batch is mixed, and keep free of old plaster.

### 2.8.2 Ready-Mixed Packaged Materials

Mix ready-mixed packaged gypsum plaster in accordance with manufacturer's printed instructions.

### 2.9 BONDING AGENT

ASTM C631, interior application.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Clean surfaces before application of gypsum plaster of projections, dust, loose particles, grease, bond breakers, and foreign matter. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or (2) that have been painted or previously plastered. Before plaster work is started, wet masonry and concrete surfaces thoroughly with a fine fog spray of clean water to produce a uniformly moist condition. Check metal grounds, corner beads, screeds, and other accessories carefully for alignment before starting work. Do not apply gypsum plaster to surfaces containing frost.

### 3.2 WORKMANSHIP

#### 3.2.1 Slump Tests

Apply Plaster by hand or machine. When a plastering machine is used, control the fluidity of gypsum plaster to have a slump of not more than 3 inch when tested using a 2 by 4 by 6 inch high slump cone. Subsequent to determining water content to meet the specified slump, do not add additional water to the mix. Conduct the slump test according to the following procedure:

- a. Place cone on level, dry, non-absorptive base plate.
- b. While holding cone firmly against base plate, fill cone with plaster taken directly from the hose or nozzle of the plastering machine, tamping with metal rod during filling to release air bubbles.
- c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.
- d. Place cone in a vertical position adjacent to freed plaster sample, using care not to shake or move base plate.
- e. Lay a straightedge across top of cone, being careful not to shake or move cone. Measure slump in inch from the bottom edge of the straightedge to the top of the slumped plaster sample.

#### 3.2.2 Application

Apply gypsum plaster in three coats, except as follows:

Gypsum plaster applied to [masonry] [and] [gypsum lath] using the two-coat double-up method.

Apply base coats with sufficient pressure and ensure plaster is sufficiently plastic to provide a strong bond to bases. Work base coats into screeds at intervals from 5 to 8 ft. Plaster must not be continuous across expansion and control joints occurring in walls, partitions, and ceilings. Finish work level, plumb, square, and true, within a tolerance of 1/8 inch in 8 ft, without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections. Form plaster work carefully around angles and contours, and well-up to screeds. Take special care to prevent sagging and consequent dropping of applications. There must be no visible junction marks in finish coat where one day's work adjoins another. [ Plastered surfaces to receive[ rubber or vinyl base coves][ wood base boards] must extend to wood ground indicated as backing for base.] Plaster not required behind built-in cabinets and equipment[, and [\_\_\_\_\_]] unless part of a fire-rated assembly.

3.2.3 Control And Expansion Joints

[Install control joints at locations indicated before applying gypsum plaster. Vertical joints must be continuous and butt horizontal joints against the vertical joints. ]Check expansion, control joints and accessories to ensure unrestrained movement, metal lath not continuous behind the joints, and area between joints do not exceed 150 sq ft.

3.2.4 Curing

3.2.4.1 Gypsum Plaster

Before the plaster has set, provide environmental controls to prevent the plaster from drying too fast. After the plaster has set, provide for rapid drying to develop high strength.

3.3 GYPSUM PLASTER WORK

ASTM C842.

3.3.1 Gypsum Plaster Thickness Requirements

Plaster thicknesses are from face of metal lath plaster base (scratch coat) or solid base surfaces.

a. Vertical Surfaces

<u>Base Types</u>	<u>Base Coat</u>	<u>Finish Coat</u>	<u>Total Thickness</u>
Metal Lath	1/2 inch	1/8 inch	5/8 inch
Masonry	1/2 inch	1/8 inch	5/8 inch
Concrete	1/2 inch	1/8 inch	5/8 inch
Other Bases	3/8 inch	1/8 inch	1/2 inch

b. Horizontal Surfaces. Total plaster thickness for metal lath plaster, masonry and concrete bases is 5/8 inch. Total thickness of plaster for

horizontal concrete surfaces is 1/8 to 3/8 inch.

- c. Where vertical and horizontal concrete surfaces require more than 5/8 inch and 3/8 inch, to produce required lines or surfaces, [attach metal plaster base for plaster application] [as indicated].

### 3.3.2 Gypsum Plaster Basecoat Work

#### 3.3.2.1 Gypsum Two-Coat System

Apply the first coat to cover the base with sufficient material and pressure to form a good bond on the wall or ceiling base. Before the first coat has set and without scratching or cracking the surface, apply a second coat (double back) of the same material proportion as the base coat to the screeds. Straighten to a true surface without application of water, and cross rake or scratch to receive the finish coat.

#### 3.3.2.2 Gypsum Three-Coat System

Apply scratch coat 3/16 to 1/4 inch thick to cover the base with sufficient material and pressure to form a good bond on the wall or ceiling base. Rake or scratch the surface and allow to set firm and hard. Apply the brown coat to bring the base coat out to the screeds, compact and straighten to a true surface without the application of water, and cross rake or scratch to receive the finish coat.

### 3.3.3 Gypsum Plaster Finish Coats

Moderately moisten or fog spray base coat of plaster that has become dry before finish coat is applied. Accelerate plaster, if necessary, to provide a setting time of not more than 4 hours from the time the plaster is mixed.

#### 3.3.3.1 Lime-Putty and Gypsum-Gauged Finish Coats

Apply lime-putty gypsum-gauged finish white coat or aggregated white coat [and high strength gypsum gauged finish] over the base coat, scratch in thoroughly, lay on well, double back, and fill out to a true, even surface. Allow the finish to dry a few minutes, then trowel well with water. Apply maximum pressure in order to compact the finish coat and provide a smooth finish free from blemishes and irregularities. Apply trowel finish coats of gypsum-gauged lime-putty over properly prepared base coats as thin as possible and 1/16 to 1/8 inch thick for conventional plaster system, except as necessary in spots to level out hollows in base coat.

#### 3.3.3.2 Keene's Cement Lime-Putty Finish Coat

Apply finish over gypsum-sand base coat only, scratch in thoroughly, lay on well, double back, and fill out to a true, even surface. Allow the finish to dry a few minutes, then trowel it well with water. Apply maximum pressure in order to compact the finish coat and provide a smooth finish free of blemishes and irregularities. Continue troweling until the finish sets.

#### 3.3.3.3 Gypsum Sand Float Finish Coat

Apply finish over the base coat, scratch in thoroughly, lay on with a trowel to an even surface, and then float with [\_\_\_\_\_] floats to a true, even surface, free of slick spots or other blemishes. Apply sand float

finishes to a maximum thickness of 1/8 inch except as necessary to level out hollow spots.

#### 3.3.3.4 Acoustical Plaster Finish Coat

Apply finish in accordance with manufacturer's printed instructions and in the thickness necessary to provide the sound absorption coefficient specified, but not be less than 1/2 inch thick.

#### 3.4 ORNAMENTAL PLASTER WORK

Complete ornamental work before the finish coat of plaster is applied to adjoining areas. Plaster for ornamental work must consist of a mixture that will produce satisfactory results for the respective conditions, be reinforced properly with fiber or zinc-coated steel wire netting as necessary to provide permanent construction, and be rigidly secured in place. Run plain moldings in place to templates and guides, with true radial lines for curved work; where it is not practicable to run such moldings, cast or run them on a bench and then secure in place firmly. Cornices and moldings must be straight or curved, true to line, and corners neat.

#### 3.5 PATCHING AND POINTING

Cut out and patch loose, cracked, damaged, or defective gypsum plaster. Patch must match existing work in texture, color and finish flush with previously applied gypsum plaster surfaces. Point work abutting or adjoining finish work in a neat manner. Remove droppings or splatterings from surfaces. Leave clean and in a condition to receive paint or other finish. Remove protective covering from floors and other surfaces, and rubbish and debris from [the interior and exterior of] the building.

-- End of Section --

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## SECTION 09 23 82

## FIREPROOF GYPSUM PLASTERING

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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E605	(1993; R 2011) Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
ASTM E736	(2000; R 2011) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E761/E761M	(1992; R 2020) Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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## 1.2 ADMINISTRATIVE REQUIREMENTS

## 1.2.1 Pre-Installation Meetings

Within [30] [\_\_\_\_\_] days of Contract Award, the Contracting Officer will schedule [a] Pre-Installation meeting[s]. Submit the following for review and approval at the Pre-Installation meeting:

- a. Installation Drawings
- b. Manufacturer's Catalog Data
- c. Fireproofing Plaster Sample
- d. Certificates of Conformance
- [ e. Special Provisions

## ]1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Installation Drawings[; G[, [\_\_\_\_]]]

## SD-03 Product Data

Manufacturer's Catalog Data[; G[, [\_\_\_\_]]]

## SD-04 Samples

Fireproofing Plaster Sample[; G[, [\_\_\_\_]]]

Mockups[; G[, [\_\_\_\_]]]

## SD-07 Certificates

Certificates of Conformance[; G[, [\_\_\_\_]]]

## SD-08 Manufacturer's Instructions

Manufacturer's Instructions[; G[, [\_\_\_\_]]]

Special Provisions[; G[, [\_\_\_\_]]]

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original unopened packages bearing the name of the product, manufacturer's name, and the Underwriters Laboratories, Inc. label.

Store materials off the ground, under cover, and away from damp surfaces and keep dry until ready to use. Discard all materials that have been exposed to water before use.

## 1.5 QUALITY CONTROL

## 1.5.1 Catalog Data

Submit [manufacturer's catalog data](#) for fireproof plaster showing applicable flame spread classification, fuel contribution, and smoke developed.

## 1.5.2 Plaster Sample

Submit no less than 1/2 pound of [Fireproofing Plaster Sample](#) for review and approval.

## 1.5.3 Drawing Requirements

Submit [installation drawings](#) indicating the fireproof plaster, framing and furring as indicated and specified. Ensure components of the installation drawings meet the requirements of indicated and specified fireproofing.



#### 1.5.4 Four Hour Fire Rated Construction

Prior to the commencement of work, submit [certificates of conformance](#) for fireproof plaster showing conformance with the [ICC IBC](#), "International Building Code", "Requirements for Four-Hour Construction". Submit [manufacturer's instructions](#) for Fireproof Plaster[ including [special provisions](#) required to install equipment components and system packages]. Indicate all detail impedances, hazards and safety precautions on drawings.

#### [1.5.5 [Mockups](#)

Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

### ]PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Fireproof Plaster

Provide gypsum-vermiculite fireproof plaster mix, consisting of one part gypsum to two parts vermiculite, conforming to [ICC IBC](#), "Requirements for 4-Hour Construction".

Ensure cohesion of the dry set material is such that the fireproofing coat will not crack or delaminate when the structural [steel ]element is subjected to a downward deflection of 1/120 of the span, and the minimum compressive strength requirement in accordance with [ASTM E761/E761M](#) is not less than [70 pounds per square inch](#).

Provide set and dried material, which when tested in accordance with [ASTM E84](#), yields the following characteristics:

- a. Flame spread            10
- b. Fuel contributed        5
- c. Smoke developed        0

##### 2.1.2 Water

Use only potable water for mixing.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Apply fireproofing plaster as specified to those areas indicated on drawings. Install per details as indicated on drawings.

##### 3.1.1 Application

Provide [pneumatic] [or] [and] [trowelled] application of fireproofing plaster in accordance with material manufacturer's written recommendations and [ASTM E736](#). Provide thickness of application as indicated and in compliance with [ASTM E605](#) and the applicable fire and local codes to provide rated fireproofing when tested in accordance with [ASTM E119](#).

Provide framing and furring that meets the requirements of [09 22 00] [09 22 36], and [as recommended by manufacturer for the installation of the fireproofing plaster thickness required] [as indicated in the drawings].

### 3.2 ADJUSTING AND CLEANING

After completion of fireproofing work, remove all application equipment. Clean all areas of ceilings, walls, and floors, adjacent or exposed to the operations of application of the fireproofing material, and other surfaces and finishes that may have been soiled by fireproofing materials.

Remove any damaged or unacceptable portions of the fireproofing plaster and replace with new work at no additional cost to the Government.

-- End of Section --

## SECTION 09 24 23

CEMENT STUCCO  
08/17, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A489	(2018; E 2018) Standard Specification for Carbon Steel Eyebolts
ASTM A580/A580M	(2018) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C841	(2003; R 2013) Installation of Interior Lathing and Furring
ASTM C847	(2014a) Standard Specification for Metal

## Lath

ASTM C897	(2015; R 2020) Aggregate for Job-Mixed Portland Cement-Based Plasters
ASTM C926	(2022) Standard Specification for Application of Portland Cement-Based Plaster
ASTM C933	(2014) Welded Wire Lath
ASTM C1032	(2014) Standard Specification for Woven Wire Plaster Base
ASTM C1063	(2022) Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Lath

## SD-03 Product Data

## Proportions and Mixing

- [ Recycled percentage of fly ash in Portland cement; S]
- [ Recycled Content for steel framing; S]
- [ Recycled Content for metal lath; S]

## SD-04 Samples

## Colored Stucco Finish Coat

Sample Panel; G[, [\_\_\_\_\_]]

## 1.3 QUALITY ASSURANCE

Submit a **SAMPLE PANEL** as follows: [One **12 inch** square stucco panel showing finish texture and color and exposed reinforcement at the edges, one **12 inch** square of reinforcement, and a **12 inch** length of each accessory proposed, prior to proceeding with stucco work.] [A sample panel of stucco, constructed at the jobsite, and located as directed, to demonstrate installation procedures, texture and color, prior to proceeding with any stucco work; panel size must be a minimum of **4 feet wide x 8 feet** high; containing each type accessory proposed for use and constructed in the vertical position. Sample panel must have exposed reinforcement at the edges. Each phase of installation such as framing, scratch coat, brown coat, finish coat and curing procedures must be demonstrated in the construction of the panel. Submit one **12 inch** square of reinforcement and one **12 inch** length of each accessory proposed for use, prior to constructing the sample panel.]

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver packaged materials to the site in the original packages and containers with labels intact and seals unbroken. Keep cementitious materials dry and stored off the ground, under cover and away from damp surfaces until ready to be used. Aggregate must be covered to prevent the absorption or loss of moisture.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Do not apply stucco when the ambient temperature is **40 degrees F** or lower, or when a drop in temperature below **40 degrees F** is expected within 48 hours after application.

### PART 2 PRODUCTS

#### 2.1 PORTLAND CEMENT

Portland cement must conform to **ASTM C150/C150M**, [gray Portland cement Type [I] [II] [III].] [white Portland cement, Type [I] [II] [III].] [Provide system that has a minimum of 15% and maximum 40% fly ash. Provide data from installation contractor identifying **recycled percentage of fly ash in Portland cement**.]

#### 2.2 COLORED STUCCO FINISH COAT

Colored stucco finish coat must be a mill mixed product using white Portland cement and requiring only the addition of and mixing with water for application. Color must be [in accordance with Section **09 06 00 SCHEDULES FOR FINISHES**] [\_\_\_\_\_]. Submit samples including both a fabricated portion of unit of work and color samples.

#### 2.3 LIME

Lime must conform to **ASTM C206**, Type S.

#### 2.4 SAND

Sand aggregate for job-mixed base coat and job-mixed finish coat stucco must conform to **ASTM C897**.

#### 2.5 ACCESSORIES

Accessories must be [roll formed galvanized steel,][ or] [rigid polyvinyl

chloride (PVC)] [\_\_\_\_], except that cornerite and striplath must be formed from steel sheets with manufacturer's standard galvanized coating. Vinyl members must be in accordance with [ASTM D1784](#). Welded wire corner reinforcements must be zinc coated, galvanized [17 gauge](#) steel wire conforming to [ASTM A1064/A1064M](#). Furring must include hangers, bolts, inserts, clips, fastenings, and attachments of number, size, and design to develop the full strength of the members.

## 2.6 STEEL FRAMING

Steel framing must be as shown and must be manufacturer's standard products with shop applied protective coating. Refer to Section [09 22 00 SUPPORTS FOR PLASTER AND GYPSUM BOARD](#).

Provide steel framing containing a minimum of 20 percent recycled content, as calculated by the sum of the percentage of post-consumer and  $\frac{1}{2}$  the percentage of pre-consumer recycled steel content. Provide data identifying percentage of [recycled content for steel framing](#).

## 2.7 METAL LATH

Metal lath must conform to [ASTM C847](#), types and weights in accordance with the various spacing shown in [ASTM C841](#). Lath for vertical application on steel and wood framing supports must be expanded metal or welded or woven wire and must have paper backing with a minimum vapor permeance of [5 perms](#). Woven wire lath must be a maximum [1-1/2 x 1-1/2 inch](#) mesh wire of not less than [0.0540 inch](#) nominal diameter and must conform to [ASTM C1032](#). Welded wire lath must conform to [ASTM C933](#), with openings not to exceed [2 x 2 inches](#). Expanded metal or wire lath must be fabricated in a manner to provide not less than [1/4 inch](#) keying between wire and paper backing and keying must be obtained by a uniform series of slots in a perforated face paper woven between the wires.

Provide Metal Lath containing a minimum of 20 percent recycled content, as calculated by the sum of the percentage of post-consumer and  $\frac{1}{2}$  the percentage of pre-consumer recycled steel content. Provide data identifying percentage of [recycled content for metal lath](#).

## 2.8 WATER

Provide clean, fresh, potable water, free from amounts of oils, acids, alkalis and organic matter that would be injurious to the stucco.

## 2.9 HANGERS

Provide hangers and attachment capable of supporting a minimum [300 pound](#) ultimate vertical load without failure of supporting material or attachment.

### 2.9.1 Wires

Conform wires to [ [ASTM A641/A641M](#), Class 1, [[0.08 inch \(12 gauge\)](#)] [[\\_\\_\\_\\_](#)] inch] in diameter.] [ [ASTM A580/A580M](#), composition 302 or 304, condition annealed stainless steel, [[0.08 inch \(12 gauge\)](#)] [[\\_\\_\\_\\_](#)] inch] in diameter.]

### [2.9.2 Straps

Provide straps of [1 by 3/16 inch](#) galvanized steel conforming to [ASTM A653/A653M](#), with a light commercial zinc coating or [ASTM A1008/A1008M](#)

with an electrodeposited zinc coating conforming to [ASTM B633](#), Type RS.

]2.9.3 Rods

Provide [3/16 inch](#) diameter threaded steel rods, zinc or cadmium coated.

]2.9.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with [ASTM A489](#). Eyebolt size must be a minimum [1/4 inch](#), [zinc coated] [cadmium plated].

2.9.5 Masonry Anchorage Devices

Comply with[ [ASTM C636/C636M](#)] [\_\_\_\_\_] for anchorage devices for [eyebolts] [machine screws] [wood screws].

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

3.2 FRAMING

Framing must be installed as indicated.

3.3 CONTROL JOINTS

Locate control joints [as indicated on the drawings] [so that unbroken areas of stucco do not exceed [144 square feet](#) with no dimension between control joints greater than [18 ft.](#)] Install prefabricated control joint members prior to the application of the stucco. Clear control joints of all stucco within the control area after stucco application and prior to final stucco set.

3.4 LATH

Install lath in accordance with [ASTM C841](#) or [ASTM C1063](#) except as otherwise specified. Metal and wire lath must be applied straight, without buckles and with joints staggered. End laps of metal lath must be not less than [1 inch](#). When paper-backed lath is used, the paper must be split from the lath at all lap areas to provide a paper to paper and lath to lath lap. Horizontal joints must be shiplapped. Lath must be interrupted at all control joints. Submit drawings showing details of construction for reinforcement, furring, and grounds; including manufacturer's installation instructions for stucco materials, and locations where each mix and coating thickness will be used.

3.4.1 Steel and Wood Supports

Apply metal lath over vertical open or solid wood and steel backing frame construction only after sheathing and air barrier has been applied to the area to receive the stucco. Fasten lath every [8 inches](#) vertically and every [16 inches](#) horizontally; and where sheets of lath are lapped. Drive fasteners to hold both lapped edges securely in place.

3.4.2 On Concrete and Masonry

Fasten lath every 8 inches vertically and every 16 inches horizontally. Where wood supports adjoin masonry or concrete in the same direction, provide casing bead, control joints, or reinforcement as indicated.

#### 3.4.3 Over Metal Lintels and Flashings

Lath over metal lintels must be extended vertically over the angles to a height of not less than 6 inches and horizontally across the underside of the lintels and must be secured in an approved manner. Lath over metal flashings must lap the flashings not less than 2 inches and must be extended vertically for a height of not less than 6 inches.

#### 3.4.4 Special Shapes, Profiles, and Contours

Special shapes, profiles, and contours must be formed with wood, metal or aluminum furring and reinforcing.

### 3.5 FURRING

Furring must be installed to true lines and surfaces and must be rigidly supported and secured in place.

### 3.6 PREPARATION OF SURFACES

Preparation of surfaces for application of stucco to solid bases such as stone, masonry or concrete must conform to the applicable requirements of ASTM C926.

### 3.7 PROPORTIONS AND MIXING

Proportions and mixing for job-mixed base coat and finish coat must conform to the applicable requirements of ASTM C926. Mixing of mill-mixed finish coat must be in accordance with the manufacturer's directions. Submit detailed description of the proposed job-mix proportions for base and finish coats; including identification of thickness of coats.

### 3.8 STUCCO APPLICATION

Stucco must be applied in three coats to a thickness of not less than 1 inch as measured from the back plane of metal reinforcement, exclusive of ribs or dimples or from the face of solid backing or support, with or without metal reinforcement, to the finished stucco surface, including moderate texture variations. Stucco application must conform to the applicable requirements of ASTM C926 and the following:

#### 3.8.1 Workmanship

Items or features of the work in connection with or adjoining the stucco must be in place, plumb, straight, and true prior to beginning the stucco work. Metal and wire lath, where required, must be in place and positioned to provide a good key at back of lath. Where lath is applied over copper, the copper must be given a heavy coat of bituminous paint. Masonry surfaces to receive stucco must be evenly dampened immediately prior to application of stucco. Each stucco coat must be applied continuously in one general direction, without allowing mortar to dry at edges. Where it is impossible to work the full dimension of a wall surface in a continuous operation, jointing must be made at a break, opening, or other natural division of the surface. Edges to be joined must be dampened slightly to



produce a smooth confluence. Exterior corners of stucco must be slightly rounded. Stucco on soffit surfaces must be pitched forward to form a drip.

### 3.8.2 Scratch Coat

Apply scratch coat not less than  $3/8$  inch thick under sufficient pressure to form good keys and to completely embed the reinforcement. Before the scratch coat has set, it must be lightly scratched in one direction and vertical surfaces must be scratched in the horizontal direction only. The scratch coat must be fog cured for a minimum of 72 hours.

### 3.8.3 Brown Coat

Evenly dampen the scratch coat to obtain uniform suction before the brown coat is applied. There must be no visible water on the surface when the brown coat is applied. The brown coat must be applied to the scratch coat with sufficient pressure to force the stucco into the scratches and must be brought to a plumb, true, even plane with rod or straightedge. When set sufficiently, the brown coat must be uniformly floated with a dry float to promote densification of the coat and to provide a surface receptive to bonding of the finish coat. Brown coat must be fog cured for a minimum of 72 hours.

### 3.8.4 Finish Coat

Dampen surfaces of the brown coat not more than 1 hour before the finish coat is to be applied to a uniform wetness with no free-standing water on the surface. The finish coat must have a [smooth trowel] [float] [trowel-textured] [rough-textured] [spray-textured] [exposed aggregate] finish and must conform to the approved sample. Fog cure the finish coat for a minimum of 48 hours. Take care to prevent staining.

### 3.8.5 Surface Tolerance

When a 10 foot straightedge is placed at any location on the finished surface of the stucco, excluding rough-textured finish, the surface must not vary more than  $1/8$  inch from the straightedge.

## 3.9 CURING AND PROTECTION

Perform fog curing by applying a fine mist of water to the stucco. Exercise care during fog curing to avoid erosion damage of the stucco surfaces. Do not use a solid stream of water. Fog not less than three times daily. Protect the stucco from the direct rays of the sun during severe drying conditions using canvas, cloth or other approved sheet material.

## 3.10 PATCHING AND POINTING

Replace or patch loose, cracked, damaged or defective work as directed. Patching must match existing work in texture and color and must be finished flush.

-- End of Section --

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## SECTION 09 26 00

VENEER PLASTER  
08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C475/C475M	(2017; R 2022) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C514	(2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board
ASTM C587	(2004; R 2014) Gypsum Veneer Plaster
ASTM C631	(2009; R 2020) Bonding Compounds for Interior Gypsum Plastering
ASTM C645	(2014; E 2015) Nonstructural Steel Framing Members
ASTM C754	(2020) Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C843	(2017) Standard Specification for Application of Gypsum Veneer Plaster
ASTM C844	(2015; R 2021; E 2021) Standard Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster
ASTM C954	(2018) Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C1002	(2020) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C1047	(2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

ASTM C1396/C1396M (2017) Standard Specification for Gypsum Board

ASTM D3678 (2019) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Interior-Profile Extrusions

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide  
<http://www.approvalguide.com/>

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance (2014) Fire Resistance Directory

## 1.2 GENERAL REQUIREMENTS

Except where otherwise indicated or specified, conform to ASTM C754, ASTM C843, and ASTM C844. Apply the gypsum veneer plaster as a [one coat] [two coat] system over a special gypsum base. The veneer plaster, gypsum base, and joint reinforcement must be products of the same manufacturer. The extent and location of veneer plaster must be as shown on the drawings. Metal framing is specified herein. [ Wood framing specified in Section 06 10 00 ROUGH CARPENTRY may be used as an option to the steel framing.]

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-03 Product Data

Gypsum Base

Gypsum Veneer Plaster

[ Recycled Content for Steel Framing or Furring; S  
 ] Descriptive data and installation instructions.

## 1.4 DELIVERY AND STORAGE

Deliver and store plaster materials in the manufacturer's original unopened containers. Store materials off the ground within a completely enclosed structure or enclosed within a weathertight covering. Store gypsum base and gypsum backing board flat to prevent warping and protect from excessive exposure to sunlight. Keep materials wrapped and separate from off-gassing materials, such as paint and adhesives. Do not use materials that have visible moisture or biological growth.

## 1.5 SCHEDULING

Commence application only after the area scheduled for veneer plaster work

is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the plaster. If the mechanical system cannot be activated before veneer plastering is begun, the plastering may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply plaster prior to the installation of finish flooring and acoustic ceiling.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum base to excessive sunlight prior to plaster application, as bond failure of the plaster may result. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of veneer plaster, while the plastering is being done, and for at least one week after the plaster is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during plaster application, set, and until plaster is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Openings can be reduced in cold weather. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following plastering and until plaster is dry.

#### [1.7 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated per [UL Fire Resistance](#) or [FM APP GUIDE](#).

### ]PART 2 PRODUCTS

#### 2.1 MATERIALS

Conform to the requirements specified below. Miscellaneous items not otherwise specified must be as recommended by the veneer plaster system manufacturer and approved prior to use. Powder driven fasteners may be used only when approved in writing.

##### 2.1.1 Steel Framing, Furring, and Related Items

[ASTM C645](#). [ Provide steel framing, furring, and related items that contain a minimum of 25 percent recycled content. Provide data identifying percentage of [recycled content for steel framing or furring](#).]

##### 2.1.2 Vapor Retarder

Foil-backed gypsum base or gypsum backing board, or 4-mil polyethylene.

##### 2.1.3 Gypsum Backing Board

[ASTM C1396/C1396M](#), [Regular] [Foil-backed] [Water-Resistant] [Type X]. Provide boards with square edges as the first ply in two-ply application. Provide 48 inches wide boards, thickness as shown except that board used for liner panels and core plies of shaftwall construction must be the size and thickness recommended by the system manufacturer.

#### 2.1.4 Gypsum Base

ASTM C1396/C1396M, [Regular] [Foil-backed] [Type X], 48 inches wide, thickness as shown. Provide square edges, rounded, or tapered as recommended by the veneer plaster manufacturer.

#### 2.1.5 Gypsum Veneer Plaster

ASTM C587. Minimum compressive strength of finish coat plaster must be 2500 psi.

#### 2.1.6 Joint Reinforcement

ASTM C475/C475M, Mesh reinforcing strip or paper tape as recommended by the veneer plaster manufacturer.

#### 2.1.7 Joint Compound

ASTM C475/C475M.

#### 2.1.8 Screws

ASTM C1002 or ASTM C954, type appropriate to use.

#### 2.1.9 Nails

ASTM C514, with corrosion-resistant treatment.

#### 2.1.10 Corner Bead, Casing Bead, and Control Joints

ASTM C1047 [or] [ASTM D3678], Corrosion protective-coated steel[, vinyl or clear anodized aluminum] as recommended by the veneer plaster manufacturer. Provide flanges free of any material that would adversely affect bonding of the plaster.

### PART 3 EXECUTION

#### 3.1 STEEL FRAMING

ASTM C754. Space framing at 16 inches on center maximum. Partitions must support applied loads such as cabinets and counters without exceeding the permitted deflection.

##### 3.1.1 Partition Framing System

Metal non-load bearing framing and furring system must be capable of carrying a transverse load of 5 psf without exceeding either the allowable stress or a deflection of L/240. Provide studs of 0.0179 inch minimum thickness for partitions having the same material and the same material thickness on both sides. For partitions using 0.0179 inch thick studs, the surfacing material must cover the full height of the partition on both sides, or the stud flange must be otherwise supported to insure rigidity. Provide studs of 0.0329 inch minimum thickness for partitions having different materials or different material thickness on the two sides. At partition ends, corners, and intersections, and at jambs of openings, fasten studs to runners with screws.

##### 3.1.2 Special Framing

Build framing for beams, columns, soffits, and other special items to the sizes, shapes, or forms indicated. Secure rigidly at each intersection with screws.

### 3.1.3 Shaftwall Framing System

Shaftwalls must be standard, tested designs. Metal framing must be in accordance with the shaftwall manufacturer's printed instructions.

### 3.1.4 Ceiling Openings

Provide support members at ceiling openings such as required for access panels, recessed light fixtures, and for air supply or exhaust. Locate support members of not less than 1 1/2 inch main runner channels and suspension wires or straps to provide at least the minimum support specified herein for furring and wallboard attachment. Provide intermediate structural members for attachment or suspension of support members.

### 3.1.5 Wall Openings

At wall openings the framing system must provide for the installation and anchorage of the required subframes or finish frames. Attach steel frames securely through built-in anchors to the nearest stud on each side of the opening with wallboard screws. Provide 0.329 inch minimum thickness double studs at both jambs of all door openings. For doors over 4 feet wide, double doors, and for extra-heavy doors (such as x-ray doors), provide doubled studs [\_\_\_\_\_] inches minimum thickness. Spot grout door frames at the jamb anchor locations with joint compound applied just prior to application of gypsum base.

### 3.1.6 Blocking

Provide blocking when mounting equipment. Cut [ metal ] [ or ] [ wood ] blocking to fit in between the framing members. Rigidly anchor blocking to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to the veneer plaster system.

## 3.2 APPLICATION OF GYPSUM BASE

Apply gypsum base and gypsum backing board to framing and furring members in accordance with ASTM C844 and the requirements specified herein. Gypsum wallboard may be used for the base ply in two-ply construction. Provide gypsum base and backing board of maximum practical length, using full length boards for vertical application. Install separate boards in moderate contact without forcing in place. Install boards tight against the framing so as to eliminate any offset in the face plane between adjoining boards. Stagger end joints of adjoining boards. Fit abutting end and edge joints. Cut boards as required to make close joints around openings. Gypsum base may be adhered to gypsum backing board with an adhesive, except where prohibited by fire rating. In multi-layer construction, offset joints between layers. Offset joints on opposite faces of the partition.

### 3.2.1 Curved Surfaces

Use bending radii in accordance with ASTM C844, TABLE 5. Bend gypsum base into place without damaging the face paper. If the base is dampened to facilitate bending, dry thoroughly, and apply a bonding agent (ASTM C631)

before plastering.

### 3.2.2 Cavity Shaftwall System

Install gypsum backing boards, core boards, and gypsum base in accordance with the shaftwall system manufacturer's printed recommendations to achieve the fire rating required.

### 3.2.3 Control Joints

Control joints in ceilings and walls must be one piece manufactured products designed for use with a veneer plaster system.

### 3.2.4 Vapor Retarder

Install foil-backed gypsum base or gypsum backing board with the reflective surface against the framing members. Install polyethylene vapor retarder with joints over framing members, and with joints lapped the full width of the framing members.

## 3.3 JOINT REINFORCEMENT

Reinforce all interior angles and flat joints prior to application of the veneer plaster. Do not use self-adhering fiberglass mesh tape. Reinforcement must be a special mesh reinforcing strip embedded in veneer plaster, or paper gypsum wallboard tape embedded in joint compound.

### 3.3.1 Mesh Reinforcing

Embed the mesh reinforcing strip in veneer plaster, so that embedment material is both under and covering the reinforcement. Allow areas of reinforcement to preset, and leave rough enough for proper bonding of the plaster coat. Reinforcement must be set but not dry, before the application of veneer plaster.

### 3.3.2 Paper Tape Reinforcing

Press the paper tape into a bedding coat of setting type joint compound, and immediately cover with a skim coat of the same compound. After the bedding and skim coats are set, apply a fill coat of joint compound. Set the reinforcement and dry thoroughly before application of veneer plaster.

## 3.4 APPLICATION OF GYPSUM VENEER PLASTER

Apply gypsum veneer plaster in accordance with [ASTM C843](#), and with the manufacturer's approved installation instructions where such instructions are additional to or more restrictive than the requirements of [ASTM C843](#). Apply plaster as a [one-component] [two-component] system. Minimum plaster thickness must be as recommended by the manufacturer, but must in no case be less than [1/16 inch for one-component system.] [1/16 inch for base coat and 1/32 inch for finish coat of a two-component system.]

### 3.4.1 Mixing

Clean mixer between batches to avoid accelerating the setting time. Do not add other plaster materials to modify the properties of the veneer plaster. When extreme conditions so demand, small quantities of commercial retarder or accelerator may be added to the mixing water to adjust setting time. When used, the retarder or accelerator must conform to the veneer



plaster manufacturer's recommendations.

### 3.4.2 Application

Trowel plaster on by hand. Apply with sufficient material and pressure to develop bond and to provide the specified component thickness.

#### 3.4.2.1 Base Coat

Scratch in the base coat tightly, then immediately double back using material from the same batch. Fill all voids and imperfections and level the plaster to a true surface without the application of water. For good bond or adhesion, roughen the final surface for bond by brushing or cross-raking with a fine wire rake. For application of finish coat, set the base coat and partially dry. If the base coat is totally dry, dampen before finish coat application.

#### 3.4.2.2 Finish Coat

Scratch in the finish coat tightly, then immediately double back using material from the same batch. After the plaster has been allowed to set up slightly, lightly trowel the surface without the addition of water, filling all voids and imperfections and eliminating surface irregularities. When the plaster has become firm and prior to set, smooth-trowel the surface using water sparingly. Avoid over troweling.

### 3.5 CLEANUP AND PATCHING

Remove plaster splashes from adjacent surfaces. Repair defects in the veneer plaster. Plaster surfaces must be smooth, clean, and in condition to receive the finishing materials that will be applied.

-- End of Section --

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## SECTION 09 29 00

GYPSUM BOARD  
08/16, CHG 4: 02/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11 (1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

## ASTM INTERNATIONAL (ASTM)

ASTM C475/C475M (2017; R 2022) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

ASTM C514 (2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board

ASTM C557 (2003; R 2017) Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing

ASTM C840 (2020) Standard Specification for Application and Finishing of Gypsum Board

ASTM C954 (2018) Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM C1002 (2020) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

ASTM C1047 (2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

ASTM C1177/C1177M (2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

ASTM C1178/C1178M (2013) Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel

ASTM C1396/C1396M (2017) Standard Specification for Gypsum

## Board

ASTM C1629/C1629M	(2018a) Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
ASTM C1766	(2015; R2019) Standard Specification for Factory-Laminated Gypsum Panel Products
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D624	(2000; R 2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D1037	(2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D1149	(2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D2394	(2017) Standard Test Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring
ASTM D3273	(2016) Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D5420	(2016) Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Strike Impacted by a Falling Weight (Gardner Impact)
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E336	(2020) Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
ASTM E695	(2003; R 2015; E 2015) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>
GREEN SEAL (GS)	
GS-36	(2013) Adhesives for Commercial Use
GYPSUM ASSOCIATION (GA)	
GA 214	(2010) Recommended Levels of Gypsum Board Finish
GA 216	(2010) Application and Finishing of Gypsum Panel Products
GA 224	(2008) Installation of Predecorated Gypsum Board
GA 253	(2012) Application of Gypsum Sheathing
GA 600	(2009) Fire Resistance Design Manual
SCIENTIFIC CERTIFICATION SYSTEMS (SCS)	
SCS	SCS Global Services (SCS) Indoor Advantage
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)	
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
UNDERWRITERS LABORATORIES (UL)	
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
UL Fire Resistance	(2014) Fire Resistance Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious Backer Units

Glass Mat Water-Resistant Gypsum Tile Backing Board

Water-Resistant Gypsum Backing Board

[ Glass Mat Covered or Reinforced Gypsum Sheathing

][ Glass Mat Covered or Reinforced Gypsum Sheathing Sealant

][ Abuse Resistant Gypsum Board

] Accessories

Submit for each type of gypsum board and for cementitious backer units.

Gypsum Board

[ Recycled Content for Gypsum Board; S

][ Recycled Content for Paper Facing and Gypsum Cores; S

] VOC Content of Joint Compound; S

#### SD-04 Samples

Predecorated Gypsum Board; G[, [\_\_\_\_\_]]

Submit for each color and pattern of predecorated gypsum board. Where colors are not indicated, submit color selection samples of not less than eight of the manufacturer's standard colors.

#### SD-06 Test Reports

[ ASTM E90 Factory Test Report; G[, [\_\_\_\_\_]]

][ ASTM E336 Field Test Report; G[, [\_\_\_\_\_]]

#### ] SD-07 Certificates

Asbestos Free Materials; G[, [\_\_\_\_\_]]

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

Indoor Air Quality for Gypsum Board; S

Indoor Air Quality for Non-aerosol Adhesives; S

Indoor Air Quality for Aerosol Adhesives; S

#### SD-08 Manufacturer's Instructions

Safety Data Sheets

#### SD-10 Operation and Maintenance Data

## Manufacturer Maintenance Instructions

### 1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

##### [1.3.1.1 Ceiling and Wall Systems

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

##### ]1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### 1.4 DELIVERY, STORAGE, AND HANDLING

#### 1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

#### 1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range.

Do not store gypsum wallboard with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants, including [\_\_\_\_\_].

Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Do not use materials that have visible moisture or biological growth.

#### 1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

### 1.5 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of [3] [\_\_\_\_\_] years of documented successful experience.

## 1.6 SCHEDULING

[The gypsum wallboard must be taped, finished and primed before the installation of the highly-emitting materials, including [\_\_\_\_].] [The gypsum wallboard must be installed after the installation and ventilation period of the highly-emitting materials, including [\_\_\_\_].]

Commence application only after the area scheduled for gypsum board work is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the gypsum board. If the mechanical system cannot be activated before gypsum board is begun, the gypsum board work may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply gypsum board prior to the installation of finish flooring and acoustic ceiling.

## 1.7 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum board to excessive sunlight prior to gypsum board application. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of gypsum board work, while the gypsum board application is being done, and for at least one week after the gypsum board is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during gypsum board application, set, and until gypsum board jointing is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Reduce openings in cold weather to prevent freezing of joint compound when applied. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following gypsum boarding and until gypsum board jointing complete and is dry.

## [1.8 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated per [UL Fire Resistance](#) or [FM APP GUIDE](#).

## ]PART 2 PRODUCTS

### 2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from [asbestos free materials](#) only. [Submit Safety Data Sheets and manufacturer maintenance instructions for gypsum materials including adhesives.](#)

#### 2.1.1 Gypsum Board

[ASTM C1396/C1396M](#). [ Gypsum board must contain a minimum of [5] [10] [\_\_\_\_] percent post-consumer recycled content, or a minimum of [20] [40] [\_\_\_\_] percent post-industrial recycled content. Provide data identifying percentage of [recycled content for gypsum board](#).] [ Paper facings must contain a minimum of 100 percent recycled paper content. Gypsum cores must



contain a minimum of [95] [\_\_\_\_\_] percent post-industrial recycled gypsum content. Provide data identifying percentage of [recycled content for paper facing and gypsum cores.](#)] Provide gypsum wall board and panels meeting the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type). Provide certification or validation of [indoor air quality for gypsum board.](#)

#### 2.1.1.1 Regular

48 inch wide, [1/2] [5/8] inch thick, [tapered] [, tapered and featured] edges. [Provide tapered and featured edge gypsum board [in Rooms [\_\_\_\_\_] ] [as indicated].]

#### 2.1.1.2 Foil-Backed

48 inch wide, [1/2] [5/8] inch thick, [tapered] [tapered and featured] edges.

#### 2.1.1.3 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, [tapered] [tapered and featured] edges.

#### 2.1.1.4 Mold Resistant / Anti-Microbial Gypsum

[ASTM D3273](#). 48 inch wide, [1/2] [5/8] inch thick, [tapered] [tapered and featured] edges.

#### 2.1.2 Gypsum Backing Board

[ASTM C1396/C1396M](#), gypsum backing board must be used as a base in a multilayer system.

#### 2.1.2.1 Regular

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### 2.1.2.2 Foil-Backed

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### 2.1.2.3 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, square edges.

#### 2.1.3 Regular [Water-Resistant Gypsum Backing Board](#)

[ASTM C1396/C1396M](#)

#### 2.1.3.1 Regular

48 inch wide, [1/2] [5/8] inch thick, tapered edges.

#### 2.1.3.2 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, tapered edges.

#### 2.1.4 [Glass Mat Water-Resistant Gypsum Tile Backing Board](#)

## ASTM C1178/C1178M

## 2.1.4.1 Regular

48 inch wide, [1/2] [5/8] inch thick, square edges.

## 2.1.4.2 Type X (Special Fire-Resistant)

48 inch wide, [1/2] [5/8] inch thick, square edges.

## [2.1.5 Glass Mat Covered or Reinforced Gypsum Sheathing

Exceeds physical properties of ASTM C1396/C1396M and ASTM C1177/C1177M. Provide [1/2] [5/8] inch, gypsum sheathing. Provide gypsum board of with a noncombustible water-resistant core, with glass mat surfaces embedded to the gypsum core or reinforcing embedded throughout the gypsum core. Warrant gypsum sheathing board for at least twelve months against delamination due to direct weather exposure. Provide continuous, asphalt impregnated, building felt to cover exterior face of sheathing. [Seal all joints, seams, and penetrations with compatible sealant.]

## [2.1.5.1 Glass Mat Covered or Reinforced Gypsum Sheathing Sealant

Provide sealant compatible with glass mat covered or reinforced gypsum sheathing, rubber washers for masonry veneer anchors, and other associated cavity wall components such as anchors and through wall flashing. Provide sealants for glass mat covered or reinforced gypsum sheathing board edge seams and veneer anchor penetrations recommended by the glass mat covered or reinforced gypsum sheathing manufacturer and have the following performance requirements:

- a. ASTM D412: Tensile Strength, 80 psi
- b. ASTM D412: Ultimate Tensile Strength (maximum elongation), 170 psi
- c. ASTM D624: Tear Strength, dieB, 27 ppi
- d. ASTM D1149: Joint Movement Capability after 14 Days cure, plus or minus 50 percent.

## ]] [2.1.6 Abuse Resistant Gypsum Board

48 inch wide, 5/8 inch thick, tapered edges.

Reinforced gypsum panel with imbedded fiber mesh or lexan backing tested in accordance with the following tests. Hard body impact test must attain a Level 2 performance in accordance with ASTM C1629/C1629M. Provide fasteners that meet manufacturer requirements and specifications stated within this section. Abuse resistant gypsum board, when tested in accordance with ASTM E84, have [a flame spread rating of 25 or less and a smoke developed rating of 50 or less for [\_\_\_\_]] [and] [a flame spread rating of 75 or less and a smoke developed rating of 100 or less for [\_\_\_\_]].

## 2.1.6.1 Soft Body Impact Test

ASTM E695 or ASTM D2394 for impact penetration and deformation. ASTM E695 using a 60 lb leather bag filled with steel pellets, resisting no less than 300 ft. lb. cumulative impact energy before failure or ASTM D2394 using 5.5 inch hemispherical projectile resisting no less than 264 ft. lb. before failure. Provide test specimen stud spacing a minimum 16 inch on center.

## 2.1.6.2 Hard Body Impact Test

Comply with hard body impact test in accordance with [ASTM C1629/C1629M](#) Classification Level 2.

#### 2.1.6.3 Surface Abrasion Test

Comply with test surface abrasion test in accordance with [ASTM C1629/C1629M](#).

#### 2.1.6.4 Indentation Test

[ASTM D5420](#) or [ASTM D1037](#) for indentation resistance. [ASTM D5420](#) using a 32 oz weight with a 5/8 inch hemispherical impacting head dropped once 3 feet creating not more than 0.137 inch indentation or [ASTM D1037](#) using no less than 470 lb weight applied to the 0.438 inch diameter ball to create not more than a 0.0197 inch indentation depth.

#### ]2.1.7 Factory-Laminated Gypsum Board

[ [ASTM C1766](#), [regular] [Type X], 48 inch wide [1/2] [5/8] inch thick, sound dampening gypsum panel products composed of [two [or more]] factory-laminated gypsum panel laminated into a composite panel.

#### ] [2.1.7.1 [ASTM E90 Factory Test Report](#)

Submit Factory Test Report for proposed STC Rated wall assembly. Test reports must be prepared by an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST). Test reports must indicate that the sound transmission classification (STC) of the proposed wall [and ceiling] assembly, based on tests at 16 third-octave band frequencies from 125 to 4,000 hertz, is no less than STC 50 for STC 45 assemblies and no less than STC 55 for STC 50 assemblies when tested in accordance with [ASTM E90](#).

#### ]2.1.8 [Predecorated Gypsum Board](#)

[ASTM C1396/C1396M](#), [regular] [Type X] gypsum board, 48 inch wide, [1/2] [5/8] inch thick, with a decorative wall covering (Class I) [or coating (Class II)] applied in-plant by the gypsum board manufacturer. The color [and pattern] of wall covering must be [\_\_\_\_\_] [as selected]. Provide [\_\_\_\_\_] color [and pattern] wall covering selected. [Furnish gypsum board with square edges, and a slight bevel to produce a shallow vee joint. Wrap all coverings around edges.] Furnish a predecorated gypsum board with [a flame spread rating of 25 or less and a smoke developed rating of 50 or less for [\_\_\_\_\_] [and] [a flame spread rating of 75 or less and a smoke developed rating of 100 or less for [\_\_\_\_\_] ].

#### 2.1.9 [Cementitious Backer Units](#)

In accordance with the Tile Council of America (TCA) Handbook.

#### 2.1.10 Joint Treatment Materials

[ASTM C475/C475M](#). Product must be low emitting VOC types with VOC limits not exceeding 50 g/L. Provide data identifying [VOC content of joint compound](#). [Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds must be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.]

2.1.10.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.10.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.10.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.10.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.10.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.11 Fasteners

2.1.11.1 Nails

ASTM C514. [For predecorated gypsum board provide special nails with factory coated heads of color to match wall covering materials as recommended by the predecorated gypsum board manufacturer.]

2.1.11.2 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.11.3 Staples

No. 16 USS gage flattened galvanized wire staples with 7/16 inch wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

<u>Length of Legs</u>	<u>Thickness of Gypsum Board</u>
1-1/8 inches	1/2 inch
1-1/4 inches	5/8 inch

2.1.12 Adhesives

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of

**SCAQMD Rule 1168.** Provide aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of **CDPH SECTION 01350** (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of **GS-36**. Provide certification or validation of **indoor air quality for non-aerosol adhesives** applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of **indoor air quality for aerosol adhesives** used on the interior of the building (inside of the weatherproofing system).

#### 2.1.12.1 Adhesive for Fastening Gypsum Board to Metal Framing

[Not permitted.] [Type recommended by gypsum board manufacturer.]

#### 2.1.12.2 Adhesive for Fastening Gypsum Board to Wood Framing

[Not permitted.] [**ASTM C557**.]

#### 2.1.12.3 Adhesive for Laminating

[Not permitted.] [Adhesive attachment is not permitted for multi-layer gypsum boards. For laminating gypsum studs to face panels, provide adhesive recommended by gypsum board manufacturer.]

#### 2.1.13 Gypsum Studs

Provide **one inch** minimum thickness and **6 inch** minimum width. Studs may be of **one inch** thick gypsum board or multilayers fastened to required thickness. Conform to **ASTM C1396/C1396M** for material and **GA 216** for installation.

#### 2.1.14 Shaftwall Liner Panel

**ASTM C1396/C1396M.** Conform to the **UL Fire Resistance** for the Design Numbers(s) indicated for shaftwall liner panels. Manufacture liner panel for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, [**1 inch**] [**3/4 inch**] thick, by **24inch** wide.

#### 2.1.15 Accessories

**ASTM C1047.** Fabricate from [corrosion protected steel] [ or ] [plastic] designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials. [For predecorated gypsum board provide prefinished metal or plastic trim to match predecorated gypsum board.]

#### 2.1.16 Asphalt Impregnated Building Felt

Provide a **15 lb** asphalt moisture barrier over glass mat covered or reinforced gypsum sheathing. Conforming to **ASTM D226/D226M** Type 1 (No. 15) for asphalt impregnated building felt.

#### 2.1.17 Water

Provide clean, fresh, and potable water.

### PART 3 EXECUTION

### 3.1 EXAMINATION

#### 3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

#### 3.1.2 [Gypsum Board] [and] [Framing]

Verify that surfaces of [gypsum board] [and] [framing] to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

#### 3.1.3 [Masonry] [and] [Concrete] Walls

Verify that surfaces of [masonry] [and] [concrete] walls to receive gypsum board applied with adhesive are dry, free of dust, oil, form release agents, protrusions and voids, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

#### 3.1.4 Building Construction Materials

Do not install building construction materials that show visual evidence of biological growth.

### 3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with [ASTM C840](#) or [GA 216](#) and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may [not ]be bonded together with an adhesive[, except where prohibited by fire rating(s)]. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. [Minimize framing by floating corners with single studs and drywall clips.\[ Install \[5/8 inch\] \[\\_\\_\\_\\_\\_\] gypsum or \[1/2 inch\] \[\\_\\_\\_\\_\\_\] ceiling board over framing at \[24 inch\] \[\\_\\_\\_\\_\\_\] on center.\]](#) Provide type of gypsum board for use in each system specified herein as indicated.

#### 3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with [ASTM C840](#), System I or [GA 216](#).

#### 3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with [ASTM C840](#), System II or [GA 216](#).

### 3.2.3 Adhesive Nail-On Application to Wood Framing

Apply in accordance with [ASTM C840](#), System III or [GA 216](#). This method may be used in lieu of [ASTM C840](#), System I at the option of the Contractor.

### 3.2.4 Semi-Solid Gypsum Board Partitions

Provide in accordance with [ASTM C840](#), System IV or [GA 216](#) .

### 3.2.5 Solid Gypsum Board Partitions

Provide in accordance with [ASTM C840](#), System V or [GA 216](#).

### 3.2.6 Adhesive Application to Interior Masonry or Concrete Walls

Apply in accordance with [ASTM C840](#), System VI or [GA 216](#).

### 3.2.7 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with [ASTM C840](#), System VIII or [GA 216](#).

### 3.2.8 Arches and Bending Radii

Apply gypsum board in accordance with [ASTM C840](#), System IX or [GA 216](#).

### 3.2.9 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass mat water-resistant gypsum tile backing board [or water-resistant gypsum backing board] in accordance with [ASTM C840](#), System X or [GA 216](#).

### 3.2.10 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with [ASTM C840](#), System XI or [GA 216](#).

### 3.2.11 Glass Mat Covered or Fiber Reinforced Gypsum Sheathing

Apply glass mat covered or fiber reinforced gypsum sheathing in accordance to gypsum association publications [GA 253](#). Follow gypsum sheathing manufacturer's requirements of design details for joints and fasteners and be properly installed to protect the substrate from moisture intrusion. Do not leave exposed surfaces of the glass mat covered or fiber reinforced gypsum sheathing beyond the manufacturer's recommendation without a weather barrier cladding. Provide continuous asphalt impregnated building felt over sheathing surface in shingle fashion with edges and ends lapped a minimum of 6 inch. Properly flash the openings. [Seal all joints, seams, and penetrations with a compatible silicone sealant.]

### 3.2.12 Floating Interior Angles

Minimize framing by floating corners with single studs and drywall clips. Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with [ASTM C840](#), System XII or [GA 216](#), for [single-ply] [and] [two-ply] applications of gypsum board to wood framing.

### 3.2.13 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with [ASTM C840](#), System XIII or [GA 216](#). Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

### 3.2.14 Application of Foil-Backed Gypsum Board

Apply foil-backed gypsum board in accordance with [ASTM C840](#), System XIV or [GA 216](#).

### 3.2.15 Application of Predecorated Gypsum Board

Apply predecorated gypsum board in accordance with [GA 224](#). Attach predecorated gypsum board with adhesive and fasteners as recommended by the manufacturer. Conceal fasteners in the finished work.

### 3.2.16 Application of Abuse Resistant Gypsum Board

Apply in accordance with applicable system of [ASTM C840](#) as specified or [GA 216](#). Follow manufacturers written instructions on how to cut, drill and attach board.

### [3.2.17 Application of Factory-Laminated Gypsum Board

Apply in accordance with manufacturer instructions for testing sound assembly. Face of laminated surface must not be on finished side of assembly.

## ]3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

### 3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with [ANSI A108.11](#). Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

### 3.3.2 Joint Treatment

[ANSI A108.11](#).

## 3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with [ASTM C840](#), [GA 214](#) and [GA 216](#). Finish plenum areas above ceilings to Level 1 in accordance with [GA 214](#). Finish water resistant gypsum backing board, [ASTM C1396/C1396M](#), to receive ceramic tile to Level 2 in accordance with [GA 214](#). Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3 in accordance with [GA 214](#). Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with [GA 214](#). Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with [GA 214](#). Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use self-adhering fiber glass mesh tape with conventional



drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

#### 3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

#### [3.4.2 Metal Trim for Predecorated Gypsum Board

Finish edges, ends, and joints of predecorated gypsum board, except prefinished vee joints and monolithic type joints, with metal or plastic trim selected to match the gypsum board finish.

#### ]3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

#### [3.5.1 Sealing for Glass Mat or Reinforced Gypsum Board Sheathing

Apply silicone sealant in a 3/8 inch bead to all joints and trowel flat. Apply enough of the same sealant to all fasteners penetrating through the glass mat gypsum board surface to completely cover the penetration when troweled flat. [Do not place construction and materials behind sheathing until a visual inspection of sealed joints during daylight hours has been completed by Contracting Officer.]

#### ]3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, [ wall[ and ceiling] framing] in accordance with the specifications contained in [ UL Fire Resistance for the Design Number(s) indicated], [or] [GA 600 for the File Number(s) indicated]. Joints of fire-rated gypsum board enclosures must be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

#### [3.7 SOUND RATED ASSEMBLIES

When sound rated assemblies are required, provide materials and application methods, including panels, insulation, types and spacing of fasteners, [ wall[ and ceiling] framing] in accordance with the contract document and the description of the assembly in the ASTM E90 Factory Test Report. Seal partitions continuously with acoustical foam or sealant (both sides) and finished to match wall wherever it abuts another element such as the floor, ceiling, wall, column, mullion, or another system or assembly.

#### ]3.8 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes. [Remove predecorated gypsum board which cannot be restored to like-new condition. Provide new predecorated gypsum board.]

### 3.9 SHAFTWALL FRAMING

Install the shaftwall system in accordance with the system manufacturer's published instructions. Coordinate bucks, anchors, blocking and other items placed in or behind shaftwall framing with electrical and mechanical work. Patch or replace fireproofing materials which are damaged or removed during shaftwall construction.

### [3.10 SOUND RATED ASSEMBLY FIELD TESTING

Provide third party testing of sound rated assemblies tested in accordance with [ASTM E336](#). Provide the [ASTM E336 Field Test Report](#) verifying that the installed assemblies perform no less than five ASTC rating points below the [ASTM E90 Factory Test Report](#). Examine, modify adjust, and retest any installation not meeting the STC Rating until compliance is obtained.

] -- End of Section --

## SECTION 09 30 10

## CERAMIC, QUARRY, AND GLASS TILING

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108/A118/A136.1	(2019) American National Standard Specifications for the Installation of Ceramic Tile
ANSI A137.1	(2019) American National Standards Specifications for Ceramic Tile
ANSI A137.2	(2019) American National Standards Specifications for Glass Tile
ANSI A137.3/A108.19	(2017) American National Standard Specifications for Gauged Porcelain Tile and Gauged Porcelain Tile Panels/Slabs

## ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C144	(2018) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C241/C241M	(2021) Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C373	(2018) Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for

Pressed Ceramic Tiles and Glass Tiles and  
Boil Method for Extruded Ceramic Tiles and  
Non-tile Fired Ceramic Whiteware Products

ASTM C648	(2020) Standard Test Method for Breaking Strength of Ceramic Tile
ASTM C847	(2014a) Standard Specification for Metal Lath
ASTM C1026	(2013; R 2018) Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling
ASTM C1027	(2009; R 2017) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C1178/C1178M	(2013) Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel
ASTM F446	(2019) Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use
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MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual	(2016) Dimension Stone Design Manual
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SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
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TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk	(2017) Handbook for Ceramic, Glass, and Stone Tile Installation
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines
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## UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program  
 For Chemical Emissions For Building  
 Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Porcelain Tile; G[, [\_\_\_\_\_]]

[ Recycled Content for Porcelain Tile; S

] Gauged [Porcelain Tile] [ and ] [Porcelain Tile Panels/Slabs]; G[, [\_\_\_\_\_]]

Quarry Tile; G[, [\_\_\_\_\_]]

[ Recycled Content for Quarry Tile; S

] Mosaic Tile; G[, [\_\_\_\_\_]]

[ Recycled Content for Mosaic Tile; S

] Large Format Glass Tile; G[, [\_\_\_\_\_]]

[ Recycled Content for Glass Tile; S

] Glazed Ceramic Wall Tile; G[, [\_\_\_\_\_]]

[ Recycled Content for Glazed Ceramic Wall Tile; S

] Transition Strips; G[, [\_\_\_\_\_]]

Metal Strips; G[, [\_\_\_\_\_]]

Setting-Bed; G[, [\_\_\_\_\_]]

Mortar, Grout, and Adhesive; G[, [\_\_\_\_\_]]

Reinforcing Wire Fabric

[ Cementitious Backer Units; G[, [\_\_\_\_\_]]

] [ Glass-Mat Gypsum Water-Resistant Backing Board; G[, [\_\_\_\_\_]]

- ] Waterproof Membrane; G[, [\_\_\_\_\_]]
- Crack Isolation Membrane; G[, [\_\_\_\_\_]]

#### SD-04 Samples

- Tile; G[, [\_\_\_\_\_]]
- Accessories; G[, [\_\_\_\_\_]]
- Transition Strips; G[, [\_\_\_\_\_]]
- Metal Strips; G[, [\_\_\_\_\_]]
- Grout; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

- [ Indoor Air Quality for Adhesives; S
- ] [ Indoor Air Quality for Sealants; S
- ] [ Water Absorption Rates
- ] SD-08 Manufacturer's Instructions

Manufacturer's Approved Cleaning Instructions

#### SD-10 Operation and Maintenance Data

- Gauged [Porcelain Tile] [ and ] [Porcelain Tile Panels/Slabs], Data Package 1; G[, [\_\_\_\_\_]]
- Porcelain Tile, Data Package 1; G[, [\_\_\_\_\_]]
- Quarry Tile, Data Package 1; G[, [\_\_\_\_\_]]
- Mosaic Tile, Data Package 1; G[, [\_\_\_\_\_]]
- Large Format Glass Tile, Data Package 1; G[, [\_\_\_\_\_]]
- Glazed Ceramic Wall Tile, Data Package 1; G[, [\_\_\_\_\_]]
- Transition Strips, Data Package 1; G[, [\_\_\_\_\_]]
- Metal Strips, Data Package 1; G[, [\_\_\_\_\_]]

### 1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited in this Section.

### [1.3.2 Water Absorption Rates Certification

Provide certification for each tile type indicating compliance with the following water absorption (wa) rates per ANSI A137.1 criteria as tested per ASTM C373 requirements.

- [ a. [Porcelain][ and ][Mosaic] Tile (Impervious): Provide water absorption (wa) of 0.5 percent or less.
- ] [b. [Mosaic][\_\_\_\_\_] Tile (Vitreous): Provide water absorption (wa) of more than 0.5 percent, but not more than 3.0 percent.
- ] [c. [Mosaic][\_\_\_\_\_] Tile (Semi-Vitreous): Provide water absorption (wa) of more than 3.0 percent, but not more than 7.0 percent.
- ] [d. [Ceramic Wall][\_\_\_\_\_] Tile (Non-Vitreous): Provide maximum water absorption (wa) of [7.0][\_\_\_\_\_] percent.

### ]1.4 QUALITY ASSURANCE

Provide installers having a minimum of two years of experience with a company specializing in performing the type of work described. Each type and color of tile to be provided from a single source. Each type and color of mortar, adhesive, and grout to be provided from the same source.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Ship tiles in sealed packages and clearly marked with the grade, type of tile, producer identification, and country of origin. Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions. Store and handle tiles per manufacturer's instructions for gauged porcelain tile and gauged porcelain tile panels/slabs.

### 1.6 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 50 degrees F and rising. Maintain temperature above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

### 1.7 WARRANTY

Provide manufacturer's warranty to repair or replace defective tiling materials and workmanship[, including tile, mortar and grout products and installation as a system,] for a period of [one year][[\_\_\_\_\_] [years]] from date of final acceptance of the work..

### 1.8 EXTRA MATERIALS

Supply an extra [2][\_\_\_\_\_] percent of each type tile used in clean and marked cartons.

## PART 2 PRODUCTS

### 2.1 TILE

Provide tiles that comply with ANSI A137.1 and are standard grade tiles[, the exception is glass tile. Furnish glass tiles that comply with ANSI A137.2][, the exception is gauged [porcelain tile][porcelain tile panels/slabs]. Furnish gauged [porcelain tile][porcelain tile panels/slabs] that comply with ANSI A137.3/A108.19]. Provide a minimum breaking strength of 125 lbs. for wall tile and 250 lbs. for floor tile in accordance with ASTM C648. Provide exterior building tile for cold climate projects that is approved by the manufacturer for exterior use when tested in accordance with ASTM C1026. Provide floor tiles with a minimum wet dynamic coefficient of friction (DCOF) value of [0.42][\_\_\_\_\_] when tested in accordance with ANSI A137.1 requirements. Provide glazed floor tile with a Class [III-Heavy Residential or Light Commercial][IV-Commercial][V-Heavy Commercial][\_\_\_\_\_] classification as rated by the manufacturer when tested in accordance with ASTM C1027 for visible abrasion resistance as related to foot traffic. For materials like tile, accessories, and transition strips submit samples of sufficient size to show color range, pattern, type and joints.

Submit manufacturers' descriptive product data for [each type of] ceramic, quarry and glass tiling indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for [each type of] ceramic, quarry and glass tiling indicated in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

#### 2.1.1 Porcelain Tile

Provide [unglazed[ through body (surface color and pattern go all the way through the tile body)]] [ or ] [glazed[ color body (body of tile is stained to match the glaze color)]] , [ rectified] porcelain tile[ and [cove][bullnose] base and trim pieces]. [Provide tile with a [V0][V1][V2][V3][V4] aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation.] Provide nominal tile size(s) of [6 by 6][12 by 12][18 by 18][12 by 24][\_\_\_\_\_] inch and [3/8][5/16][\_\_\_\_\_] inch thick.

Provide porcelain tiling materials that contain a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for porcelain tile.

#### 2.1.2 Gauged [Porcelain Tile][ and ][Porcelain Tile Panels/Slabs]

Provide [unglazed [through body (surface color and pattern go all the way through the tile body)]] [ or ] [glazed [color body (body of tile is stained to match the glaze color)]] , [rectified] gauged [porcelain tile] [porcelain tile panels/slabs] [and [cove] [bullnose] base and trim pieces]. [Provide tile with a [V0][V1][V2][V3][V4] aesthetic classification.] Blend tiles in factory and in packages to have same color range and continuous blend for installation. Provide nominal tile size(s) of [30 by 15][30 by 30][60 by 30][60 by 60][120 by 60] [\_\_\_\_\_] inch and [1/8][1/4][\_\_\_\_\_] inch thick.

Provide gauged [porcelain tile] and [porcelain tile panels/slabs] materials that contain a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for gauged [porcelain tile] and [porcelain tile panels/slabs].

#### [2.1.3 Quarry Tile



Furnish an unglazed quarry tile, [cove][bullnose] base and trim pieces. Provide tile with [smooth][abrasive] surface. Provide nominal tile size(s) of [6 by 6][\_\_\_\_\_] inch and 1/2 inch thick.

Provide quarry tiling materials that contain a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for quarry tile.

2.1.4 Mosaic Tile

Furnish [unglazed][glazed], mosaic tile[, [cove][bullnose] base] and trim composed of [ceramic][porcelain][glass][stone][metal]. [Provide tile with a [V0][V1][V2][V3][V4] aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation.] Provide [nominal tile size(s) of [1 by 1][1 by 2][2 by 2][\_\_\_\_\_] inch][a mixture of standard sizes in a stock pattern].

Provide mosaic tiling materials that contain a minimum of 3 percent recycled content. Provide data identifying percentage of recycled content for mosaic tile.

2.1.5 Large Format Glass Tile

[Provide tile with a [V0][V1][V2][V3][V4] aesthetic classification.] Provide nominal tile size(s) of [3 by 3][\_\_\_\_\_] inches or greater.

Provide glass tiling materials that contain a minimum of [10][\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for glass tile.

2.1.6 Glazed Ceramic Wall Tile

Provide glazed[, rectified] ceramic wall tile that has [cushioned edges][square edges] and trim with lead-free [bright][matte] finish. Provide nominal tile size(s) of [4-1/4 by 4-1/4][4-1/4 by 6][6 by 6] inch.

Provide glazed ceramic wall tile materials that contain a minimum of 3 percent recycled content. Provide data identifying percentage of recycled content for glazed ceramic wall tile.

2.1.7 Accessories

Provide built-in type accessories of the same materials and finish as the wall tile. Provide accessories as follows:

	Quantity	Location
Recessed soap holders	[_____]	[_____]
Tumbler holders	[_____]	[_____]
Combination tumbler and toothbrush holders	[_____]	[_____]

	Quantity	Location
Towel bars, [stainless steel][ceramic] [24] [30] inch long, two towel posts	[_____]	[_____]
Robe hooks	[_____]	[_____]
Roll paper holder	[_____]	[_____]
Recessed soap holder and hand hold combination: support static load in compliance with ASTM F446	[_____]	[_____]
Premade niche and shelf	[_____]	[_____]

2.2 SETTING-BED

Submit manufacturer's catalog data. Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

2.2.6 Reinforcing Wire Fabric

Conform to ASTM A1064/A1064M for wire fabric. Provide [2 by 2 inch mesh, 16/16 wire] [or] [1-1/2 by 2 inch mesh, 16/13 wire].

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

[Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). For products located on the interior of the building (inside of the weatherproofing system, provide certification or validation of [indoor air quality for adhesives](#).) Provide bond coat, mortar, and grout supplied from the same manufacturer.

#### 2.4.1 Dry-Set Portland Cement Mortar

[TCNA Hdbk](#).

#### 2.4.2 Furan Mortar

[TCNA Hdbk](#).

#### 2.4.3 Latex-Portland Cement Mortar

[TCNA Hdbk](#).

#### 2.4.4 Ceramic Tile [Grout](#)

[TCNA Hdbk](#); petroleum-free and plastic-free [sand-portland cement grout] [standard unsanded cement grout (dry-set grout)] [high-performance cement grout (latex-portland cement grout)] [standard cement commercial portland cement grout].

#### 2.4.5 Organic Adhesive

[TCNA Hdbk](#), Type I. Water-resistant. Comply with [ANSI A108/A118/A136.1](#).

#### 2.4.6 Epoxy Resin Grout

[TCNA Hdbk](#). Water cleanable epoxy conforming to [ANSI A108/A118/A136.1](#); provide manufacturer proportioned and packaged kit having hardener, resin and colored filler and horizontal and vertical grade products as applicable. Provide antimicrobial additive designed for prevention of mold and mildew.

#### 2.4.7 Furan Resin Grout

[TCNA Hdbk](#); chemical resistant furan conforming to [ANSI A108/A118/A136.1](#); and consist of an intimate mixture of furfuryl-alcohol resin with carbon filler and catalyst. [Prohibited unless specifically indicated otherwise](#).

#### 2.4.8 Urethane Grout

[TCNA Hdbk](#); premixed, urethane, water-based grout with color consistency and antimicrobial protection; no color fading, streaking or shading, chemical and stain resistant; and UV stable.

#### 2.4.9 Sealants

Comply with applicable regulations regarding toxic and hazardous materials

and as specified. Provide sealant that does not change the color or alter the appearance of the grout. Refer to Section 07 92 00 JOINT SEALANTS.

[Provide sealants used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. For products located on the interior of the building (inside of the weatherproofing system), provide certification or validation of indoor air quality for sealants.]

## 2.5 SUBSTRATES

[Refer to Section 09 29 00 GYPSUM BOARD] [ for cementitious backer units] [ and ] [glass-mat water-resistant backing board].

### [2.5.1 Cementitious Backer Units

Provide cementitious backer unit, for use as tile substrate as indicated, in accordance with TCNA Hdbk. Furnish [1/2] [5/8] inch thick cementitious backer units.

### ] 2.5.2 Glass-Mat Gypsum Water-Resistant Backing Board

Provide glass-mat water-resistant backing board, for use as tile substrate as indicated, in accordance with ASTM C1178/C1178M. Provide [1/2] [5/8] inch thick glass-mat water-resistant backing board.

## ] 2.6 MISCELLANEOUS TRIMS

### 2.6.1 Transition Strips

Provide [[clear] [\_\_\_\_\_] anodized aluminum transitions between tile and carpet or resilient flooring. Provide types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified] [marble transitions appropriate for conditions]. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble, [white] [pink] [gray] [beige] in color. Provide [minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.] [solid surfacing material transitions appropriate for conditions. Refer to Section 06 61 16 SOLID SURFACING FABRICATIONS.] Provide transition strips that comply with 36 CFR 1191 requirements.

### 2.6.2 Metal Strips

Provide [Cove] [,] [Angle] [,] [and] [L-shape] [,] [\_\_\_\_\_] trim shapes, height to match tile and setting thickness, designed specifically for flooring, and wall applications. [Provide [extruded, [clear] [\_\_\_\_\_] anodized aluminum] [stainless steel] [rigid-vinyl] cove strip where floor tile abuts wall tile for sanitary transition and elimination of cove tile base.] [Provide extruded [radiused] [square] [\_\_\_\_\_] [,] [[clear] [\_\_\_\_\_] anodized aluminum] [stainless steel] edging at tile surfaces with exposed outside [and inside] corners.] [Provide profiles appropriate for finished floor and wall materials as indicated.]

## 2.7 WATERPROOF MEMBRANE

### 2.7.1 General

Manufacturer's standard product that complies with ANSI A108/A118/A136.1

and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

### 2.7.2 Chlorinated-Polyethylene Shower Waterproof Membrane

Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; [0.040] [\_\_\_\_\_] inch nominal thickness.

## 2.8 CRACK ISOLATION MEMBRANE

### 2.8.1 General

Manufacturer's standard product that complies with ANSI A108/A118/A136.1 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

### 2.8.2 Chlorinated-Polyethylene Crack Isolation Membrane

Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; [0.030] [\_\_\_\_\_] inch nominal thickness.

## 2.9 COLOR, TEXTURE, AND PATTERN

Provide color, pattern and texture [as specified in Section 09 06 00 SCHEDULES FOR FINISHES.] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.].

## PART 3 EXECUTION

### 3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCNA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Organic Adhesives	1/8 inch in 8 ft.	1/16 inch in 3 ft.
Latex-Portland Cement Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Epoxy	1/8 inch in 8 ft.	1/8 inch in 10 ft.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses,

offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer. Dimension and draw [detail drawings](#) at a minimum scale of 1/4 inch = 1 foot. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern [elevations] [ and ] [floor plans]. Submit manufacturer's preprinted installation instructions.

Do not install building construction materials that show visual evidence of biological growth.

### 3.3 INSTALLATION OF SUBSTRATES

#### 3.3.1 [Cementitious Backer Units] [and] [Glass-Mat Water-Resistant Backing Board]

Install [as specified in Section 09 29 00 GYPSUM BOARD.] [in accordance with manufacturer's written instructions.]

### 3.4 INSTALLATION OF WALL TILE

Install wall tile in accordance with the [TCNA Hdbk](#), method [\_\_\_\_\_] and with grout joints [[as recommended by the manufacturer for the type of tile] [of [\_\_\_\_\_] inch]. [Install thinner wall tile flush with thicker wall tile applied on same wall and provide installation materials as recommended by the tile and setting materials manufacturer's to achieve flush installation.]]

#### 3.4.1 Installation of Gauged [Porcelain Tile] [Porcelain Tile Panels/Slabs]

Install gauged [porcelain tile] [porcelain tile panels/slabs] in accordance with [TCNA Hdbk](#) method [\_\_\_\_\_] and [ANSI A137.3/A108.19](#) for thin-bed method bonded with modified dry-set cement mortar over improved modified dry-set cement mortar.

#### 3.4.2 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to [TCNA Hdbk](#) method [\_\_\_\_\_] for workable mortar bed, materials, and installation of tile. Conform to [TCNA Hdbk](#) method [\_\_\_\_\_] for cured mortar bed and materials.

#### 3.4.3 Dry-Set Mortar and Latex-Portland Cement Mortar

Use [dry-set] [or] [latex-portland cement] to install tile in accordance with [TCNA Hdbk](#) method [\_\_\_\_\_] . Use latex-portland cement when installing porcelain ceramic tile.

#### 3.4.4 Organic Adhesive

Comply with the requirements of [TCNA Hdbk](#) method [\_\_\_\_\_] for organic

adhesive installation of ceramic tile.

#### 3.4.5 Furan Mortar and Grout

Comply with the requirements of **TCNA Hdbk** method [\_\_\_\_\_] for furan mortar and grout installation.

#### 3.4.6 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with **TCNA Hdbk** method [\_\_\_\_\_] . [Provide and apply manufacturer's standard [\_\_\_\_\_] product for sealing grout joints in accordance with manufacturer's recommendations.]

#### 3.4.7 Epoxy Resin Grout

Prepare and install epoxy resin grout in accordance with **TCNA Hdbk** method [\_\_\_\_\_] .

#### 3.4.8 Urethane Grout

Prepare and install urethane grout in accordance with **TCNA Hdbk** method [\_\_\_\_\_] .

### 3.5 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with **TCNA Hdbk** method [specified herein] [\_\_\_\_\_] and with grout joints [as recommended by the manufacturer for the type of tile] [of [\_\_\_\_\_] inch] . Install shower receptors in accordance with **TCNA Hdbk** method [B414] [B415] [\_\_\_\_\_] .

#### 3.5.1 Installation of Gauged [Porcelain Tile] [Porcelain Tile Panels/Slabs]

Install gauged [porcelain tile] [porcelain tile panels/slabs] in accordance with **TCNA Hdbk** method [\_\_\_\_\_] and **ANSI A137.3/A108.19** for thin-bed method bonded with modified dry-set cement mortar over improved modified dry-set cement mortar.

#### 3.5.2 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to **TCNA Hdbk** method [\_\_\_\_\_] for workable mortar bed materials and installation. Conform to **TCNA Hdbk** method [\_\_\_\_\_] for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

#### 3.5.3 Dry-Set and Latex-Portland Cement

Use [dry-set] [or] [latex-portland cement] mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with **TCNA Hdbk** method [\_\_\_\_\_] . Use latex-portland cement when installing porcelain ceramic tile.

#### 3.5.4 Resinous Grout

When resinous grout is indicated, grout quarry tile with either furan grout conforming to **ANSI A108/A118/A136.1** or epoxy resin grout conforming to **ANSI A108/A118/A136.1** . Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with **TCNA Hdbk** method [\_\_\_\_\_] . Install resin

grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed with furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be grouted. Protect finished grout of grout stain.

### 3.5.5 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk method [\_\_\_\_]. Provide and apply manufacturer's standard [\_\_\_\_] product for sealing grout joints in accordance with manufacturer's recommendations.

### 3.5.6 Waterproof and Crack Isolation Membranes

Install as indicated in accordance with manufacturer's written instructions.

### 3.5.7 Concrete Fill

Provide a 3500 psi concrete fill mix to dry as consistency as practicable. [Compose concrete fill by volume of 1 part Portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mix with water to as dry a consistency as practicable.] Spread, tamp, and screed concrete fill to a true plane, and pitch to drains or levels as shown. Thoroughly damp concrete fill before applying setting-bed material. Reinforce concrete fill with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped a minimum 2 inch. Tie laps together with 18 gauge wire every 10 inch along the finished edges and every 6 inch along the cut ends and edges. Provide reinforcement with support and secure in the centers of concrete fills. Provide a continuous mesh; except where expansion joints occur, cut mesh and discontinue across such joints. Provide reinforced concrete fill under the setting-bed where the distance between the under-floor surface and the finished tiles floor surface is a minimum of 2 inches, and of the same thickness that the mortar setting-bed over the concrete fill with the thickness required in the specified TCNA Hdbk method [\_\_\_\_].

## 3.6 INSTALLATION OF MISCELLANEOUS TRIMS

### 3.6.1 Transition Strips

Install transition strips where indicated, in a manner similar to that of the ceramic tile floor and as recommended by the manufacturer. Provide thresholds full width of the opening. Install head joints at ends not exceeding 1/4 inch in width and grouted full.

### 3.6.2 Metal Trims

Install trim where indicated. Embed anchoring leg in setting mortar in accordance with manufacturer's instructions. During grouting of tile joints, immediately wipe grout from finish surface.

## 3.7 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

### 3.7.1 Walls

Provide expansion joints at control joints in backing material. Wherever



backing material changes, install an expansion joint to separate the different materials.

### 3.7.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs in accordance with TCNA Hdbk method [\_\_\_\_\_] EJ171 type to suit conditions. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 20 to 25 feet each way in large interior floor areas[.] [ and 8 to 12 feet each way in large exterior areas or areas exposed to direct sunlight or moisture.] Extend expansion joints through setting-beds and fill.

### 3.8 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with [manufacturer's approved cleaning instructions](#). Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles.

-- End of Section --

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## SECTION 09 35 16

## CHEMICAL-RESISTANT QUARRY TILING

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C267	(2020) Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
ASTM C395	(2001; R 2012) Chemical-Resistant Resin Mortars
ASTM C413	(2018) Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
ASTM C658	(1998; R 2012) Chemical-Resistant Resin Grouts for Brick or Tile

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
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## TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk	(2017) Handbook for Ceramic, Glass, and Stone Tile Installation
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Quarry Tile; G[, [\_\_\_\_]]

Recycled Content for Chemical-Resistant Quarry Tile; S

Grout; G[, [\_\_\_\_\_]]

Indoor Air Quality for Mortar and Grout; S

#### SD-04 Samples

Quarry Tile; G[, [\_\_\_\_\_]]

Grout; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Grout; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Quarry Tile

Grout; G[, [\_\_\_\_\_]]

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in manufacturers' original unbroken packages or containers plainly labeled with manufacturers' names and brands. Grade mark tile containers. Store materials in dry locations. Handle materials in a manner that will prevent inclusion of foreign materials and damage by water, dampness, or temperature extremes. Store materials in area in which they will be used at temperatures not lower than 60 degrees F at least 24 hours before use.

### 1.4 ENVIRONMENTAL REQUIREMENTS

Do not start tile work unless ambient temperature of work area is at least 60 degrees F and rising, and slab temperature is not less than 60 degrees F. Maintain room and slab at these minimum temperatures without interruption while work is in progress and for at least 3 days after completion of work.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Provide materials conforming to the standards, specifications, and other requirements listed below:

#### 2.1.1 Quarry Tile

TCNA Hdbk, standard grade, [\_\_\_\_\_] by [\_\_\_\_\_] [6 by 6 inches] by [minimum 1/2 inch] [\_\_\_\_\_] thick, color [indicated] [selected by the Contracting Officer from the manufacturer's standard color samples.] [Minimum thickness in Garbage Room must be 1-1/4 by 8 by 8 inches.] Quarry tile must have flat or serrated back. Chemical-Resistant Quarry Tiling Materials must contain a minimum of [3] [10] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for chemical-resistant quarry tile.

##### 2.1.1.1 Slip-Resistant Quarry Tile

Provide quarry tile for floors [of [\_\_\_\_]] that contain an abrasive aggregate uniformly embedded into face surface of tile. Abrasive aggregate must be fused aluminum oxide or other rustproof aggregate of comparable hardness having a grain size smaller than 16 mesh and larger than 100 mesh (US Standard Sieve Sizes). Tile provided must contain grains in the surface between 50 percent and 150 percent, on the average by count, and as much aggregate as the approved samples.

#### 2.1.1.2 Quarry Tile Trim Units

TCNA Hdbk standard grade. Provide cove base around perimeter of floors and at vertical projections through floors. Provide bullnose trim around depressions in floors. Provide rounded internal and external corners with 1/2 inch minimum radius using appropriate matching corner units.

#### 2.1.2 Chemical-Resistant Mortar and Grout

Provide chemical-resistant grout for quarry tile floors [in [\_\_\_\_]]. Provide a compatible system of setting bed and joint material from a single source. In addition to the chemical resistance and physical properties specified, conform mortar and grout to the following:

[ Provide mortar and grout products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide validation of indoor air quality for mortar and grout from certification body.]

##### 2.1.2.1 Furan Mortar

ASTM C395. Either two-component or three-component is acceptable.

##### 2.1.2.2 Furan Grout

ASTM C658.

##### 2.1.2.3 Epoxy

ASTM C395 for setting tile grouted with furan.

##### 2.1.2.4 Epoxy Mortar and Grout

TCNA Hdbk.

## 2.2 FACTORY TESTS

### 2.2.1 Chemical Resistance

Test mortar and grout in accordance with ASTM C267 except as modified herein. Immerse test specimens in the test solutions for 28 days, and maintain solutions continuously at 175 degrees F for furan and 140 degrees F for epoxy. The test specimens must not change in weight more than 5 percent after immersion, or exhibit a compressive strength of less than 90 percent of the compressive strength of specimens that have aged in air at 70 to 80 degrees F during conditioning period. Test for chemical resistance to the following solutions:

- a. Acetic acid, 5 percent
- b. Citric acid, 5 percent
- c. Lactic acid, 5 percent
- d. Sodium hypochlorite, 5 percent
- e. Trisodium phosphate, 5 percent
- f. Household ammonia (test at room temperature)
- g. Sugar, saturated solution
- h. Vegetable oil

### 2.2.2 Physical Properties

After curing for 7 days at 70 to 80 degrees F, the mortar must:

- a. have a water absorption of not more than 0.5 percent when tested in accordance with ASTM C413;
- b. have a hardness of not less than 90 percent of its initial hardness immediately before exposure, when tested after being exposed for 6 hours at 130 degrees F for epoxy resin mortar and 200 degrees F for furan resin mortar. Conduct hardness tests on 3/8 by 3/4 inch samples with a Barcol Hardness Tester, within 30 seconds after the samples are removed from the oven.

## PART 3 EXECUTION

### 3.1 PREPARATION

Do not start tile work until rough-in for plumbing, heating, ventilating, air conditioning, and electrical work has been completed and tested [and membrane waterproofing has been installed and tested]. Protect the work of other trades in area where tile work is to be done.

#### 3.1.1 Preparation of Tile

[Factory coat] [Coat] with hot paraffin wax to produce a thin continuous film on the face surfaces only of quarry tile units to be installed and grouted with furan. Apply wax in such manner that it will not get on edges or backs of tile. Handle tile in a manner that will prevent waxed surfaces of units from touching the backs or edges of other units. Remove from the job tile with wax on edges or backs. Verify that wax used is acceptable to grout manufacturer. With flatback or serrated back tile use 1/4 inch square notched trowel with notches on 1/2 inch centers.

#### 3.1.2 Preparation of Concrete Floors for Setting Beds

Before tile is applied, test structural floor for levelness or uniformity of slope by water. Fill, level, and retest areas as required to meet tolerances specified in TCNA Hdbk and retest. When specified levelness or uniformity of slope is obtained, prepare floors for setting bed in accordance with TCNA Hdbk. Free floors of sealers, coatings, oil, dirt, and dust. Prepare floors before application of resin mortar in accordance with printed instructions and recommendations of the mortar manufacturer.

### 3.2 INSTALLATION

Except where specified otherwise herein, apply materials in accordance with manufacturer's printed instructions, including recommended safety requirements.

#### 3.2.1 Setting Bed

Using a plain (not serrated) trowel, apply a continuous setting bed of chemical-resistant mortar, not less than  $1/8$  inch thick. Apply only over a floor area that can be tiled during "open time" of mortar. Place tile into setting bed and tap lightly to a true plane. Level tile as it is placed. Maintain uniform tile joints of  $1/4$  inch minimum and  $3/8$  inch maximum width. Allow the setting bed to cure sufficiently to anchor tile in place, but not less than 24 hours, at a floor temperature of not less than 60 degrees F. When furan setting bed is used, first install a glass reinforced asphalt membrane. With flatback or serrated back tile use trowel with  $1/4$  inch square notches on  $1/2$  inch centers.

#### 3.2.2 Tile Joints

After the setting bed has cured, fill tile joints with chemical-resistant grout. Spread grout on surface of tile and work it into the open joints with a trowel. Fill joints flush with top surfaces of tile. Remove excess grout with one pass of a trowel or squeegee pulled diagonally across joints in order to prevent imperfect filling and low joints. Immediately fill voids, pinholes, and depressions with additional grout. Protect completed joints from dampness. Permit grout to harden for not less than 72 hours. Flush cure joints with tile edges; contour depression must not exceed  $3/64$  inch for  $1/4$  inch wide joints or  $1/16$  inch for  $3/8$  inch wide joints. Sealants for expansion joints provided by the grout manufacturer must be compatible with grout and setting mortars. Completely fill joints with no back up foam or rope. Install joints maximum 20 feet on center above slab around room peripheries and columns but not at drains.

#### 3.2.3 Tile Installation

Install and grout tile with water cleanable tile setting and grouting epoxy in accordance with TCNA Hdbk.

### 3.3 CLEANING

After grout has hardened, scrub and wash tile surfaces with steam or hot water to melt wax coating and remove excess grout. Remove remnants of grout with wide-bladed paint scraper or other tool that will not damage tile. Rinse tile with clean warm water applied with a flat sponge. Remove excess water from floor, and leave floor dry when work is completed. Remove tile from which surface grout cannot be removed without damage to tile. Remove damaged tile and provide new tile.

### 3.4 PROTECTION

Cover finished tile floors with clean building paper before permitting foot traffic on them. Place board walkways on floors that are to be continuously used as passageways by workmen.

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## SECTION 09 51 00

## ACOUSTICAL CEILINGS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A489	(2018; E 2018) Standard Specification for Carbon Steel Eyebolts
ASTM A580/A580M	(2018) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2017) Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2017) Standard Specification for Latex

## Sealants

ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E413	(2022) Classification for Rating Sound Insulation
ASTM E580/E580M	(2022) Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions
ASTM E795	(2016) Standard Practices for Mounting Test Specimens During Sound Absorption Tests
ASTM E1111/E1111M	(2014; R 2022) Standard Test Method for Measuring the Interzone Attenuation of Open Office Components
ASTM E1264	(2022) Standard Classification for Acoustical Ceiling Products
ASTM E1414/E1414M	(2021a) Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E1477	(1998a; R 2017; E 2018) Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use
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## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
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## U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01

(2019, with Change 1, 2022) Structural  
Engineering

UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Approved Detail Drawings; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Acoustical Ceiling Systems; G[, [\_\_\_\_\_]]

Fire Resistive Ceilings; G[, [\_\_\_\_\_]]

- [ Recycled Content for Type III Ceiling Tiles; S
- ][ Recycled Content for Type IV Ceiling Tiles; S
- ][ Recycled Content for Type IX Ceiling Tiles; S
- ][ Recycled Content for Type XII Ceiling Tiles; S
- ][ Recycled Content for Suspension Systems; S
- ] Acoustical Performance; G[, [\_\_\_\_\_]]

## SD-04 Samples

Acoustical Units; G[, [\_\_\_\_\_]]

Acoustical Ceiling Tiles; G[, [\_\_\_\_\_]]

## SD-06 Test Reports

Fire Resistive Ceilings; G[, [\_\_\_\_\_]]

## SD-07 Certificates

- [ Indoor Air Quality for Type III Ceiling Tiles; S
- ][ Indoor Air Quality for Type IV Ceiling Tiles; S
- ][ Indoor Air Quality for Type V Ceiling Tiles; S
- ][ Indoor Air Quality for Type VI Ceiling Tiles; S

- ] [ Indoor Air Quality for Type VII Ceiling Tiles; S
- ] [ Indoor Air Quality for Type IX Ceiling Tiles; S
- ] [ Indoor Air Quality for Type X Ceiling Tiles; S
- ] [ Indoor Air Quality for Type XI Ceiling Tiles; S
- ] [ Indoor Air Quality for Type XII Ceiling Tiles; S
- ] [ Indoor Air Quality for Impact/Abrasion Resistant Ceiling Tiles; S
- ] [ Indoor Air Quality for Humidity Resistant Ceiling Tiles; S
- ] [ Indoor Air Quality for Adhesives; S
- ] [ Indoor Air Quality for Sealants; S

### ] 1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

##### 1.3.1.1 Ceiling Tiles

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this section. Provide current product certification documentation from certification body.

##### 1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited in this Section.

#### 1.4 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than **60 degrees F** nor more than **85 degrees F** and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

#### 1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and

terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

#### 1.7 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship including but not limited to, sagging and warping of panels and rusting and of grid systems, for a period of [ten years] [\_\_\_\_\_] [years] from date of final acceptance of the work.

#### [1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of [\_\_\_\_\_] [5] tiles for each 1000 tiles installed.

### ]PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. Provide the unit size, texture, finish, and color as specified. [ The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to provide I-P RLF, then provide I-P products for other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills.] Coordinate the entire ceiling system with other details, like the location of access panels and ceiling penetrations, for instance, shown on the drawings. The Contractor is responsible for the final assembly and performance of the specified work [ and products if I-P products are used]. Provide the location and extent of acoustical treatment as shown on the [approved detail drawings](#). Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. [ Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.]

##### 2.1.1 [Fire Resistive Ceilings](#)

Rate [acoustical ceiling systems](#), indicated as fire resistant, for fire endurance as specified when tested in accordance with [ASTM E119](#). Test suspended ceiling with a specimen [roof] [floor] assembly representative of the indicated construction, including mechanical and electrical work within ceiling space openings for light fixtures, and air outlets, and access panels. Provide ceiling assembly rating for [[1] [1-1/2] [2] [3] [4] hour [concealed grid system] [exposed grid system]] [as shown on drawings]. Provide acoustical units with a flame spread of 25 or less and smoke development of 50 or less when tested in accordance with [ASTM E84](#).

Submit manufacturer's catalog showing UL classification of fire-rated ceilings giving materials, construction details, types of floor and roof constructions to be protected, and UL design number and fire protection time rating for each required floor or roof construction and acoustic ceiling assembly.

Submit reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified [fire endurance] [and] [sound transmission] requirements. Data attesting to conformance of the proposed

system to Underwriters Laboratories requirements for the fire endurance rating listed in UL Fire Resistance may be submitted in lieu of test reports.

## 2.1.2 Acoustical Performance

### 2.1.2.1 Ceiling Sound Transmission

Provide ceiling systems with the specified Ceiling Attenuation Class (CAC) ratings as determined in accordance with [ASTM E1414/E1414M](#) and [ASTM E413](#). Provide sound attenuators over light fixtures, air terminals and other ceiling penetrations, provide acoustical blanket insulation on top of the ceiling or adjacent to partitions to provide lightweight acoustical plenum barriers above partitions as required to achieve the specified CAC ratings. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

### 2.1.2.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with [ASTM C423](#). Determine Articulation Class (AC) in accordance with [ASTM E1111/E1111M](#).

### 2.1.3 Light Reflectance

Determine light reflectance factor in accordance with [ASTM E1477](#) test method.

## 2.2 ACOUSTICAL UNITS

Submit samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to [ASTM E1264](#), Class A, and the following requirements:

### 2.2.1 Units for Exposed-Grid System [A] [\_\_\_\_\_]

#### 2.2.1.1 Type

[III (non-asbestos mineral fiber with painted finish). [ Provide Type III Acoustical Ceiling Tiles containing a minimum of 30 percent recycled content. Provide data identifying percentage of recycled content for Type III ceiling tiles. Provide certification of indoor air quality for Type III Ceiling Tiles.]]

[IV (non-asbestos mineral fiber with membrane-faced overlay). [ Provide Type IV Acoustical Ceiling Tiles containing a minimum of 60 percent recycled content. Provide data identifying percentage of recycled content for Type IV ceiling tiles. Provide certification of indoor air quality for Type IV Ceiling Tiles.]]

[IX (mineral fiber with scrubbable finish). [ Provide Type IX Acoustical Ceiling Tiles containing a minimum [50] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for Type IX ceiling tiles. Provide certification of indoor air quality for Type IX Ceiling Tiles.]]

[X (mineral composition with plastic membrane). [ Provide certification of indoor air quality for Type X Ceiling Tiles.]]

[XI (mineral fiber with fabric faced overlay). [ Provide certification of

indoor air quality for Type XI Ceiling Tiles.]]

[XII (fiberglass base with membrane-faced overlay).[ Provide Type XII Acoustical Ceiling Tiles containing a minimum of [25] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for Type XII ceiling tiles. Provide certification of indoor air quality for Type XII Ceiling Tiles.]]

#### 2.2.1.2 Flame Spread

Class A, 25 or less

#### 2.2.1.3 Pattern

[A] [B] [C] [D] [E] [F] [G] [I] [J] [K] [\_\_\_\_\_] ]

#### 2.2.1.4 Minimum NRC

[\_\_\_\_\_] when tested on mounting Type E-400 of ASTM E795.

#### 2.2.1.5 Minimum Light Reflectance Coefficient

[LR-1, 0.75 or greater] [\_\_\_\_\_] ]

#### 2.2.1.6 Nominal Size

[24 by 48] [24 by 24] [\_\_\_\_\_] inch

#### 2.2.1.7 Edge Detail

[Square] [Reveal] [Trimmed and butt] [Beveled] [Tegular] [\_\_\_\_\_] ]

#### 2.2.1.8 Finish

Factory-applied standard finish. See paragraph COLORS AND STANDARDS.

#### 2.2.1.9 Minimum CAC

[\_\_\_\_\_] ]

#### 2.2.2 Units for Concealed-Grid System [A] [\_\_\_\_\_] ]

##### 2.2.2.1 Type

[III (non-asbestos mineral fiber with painted finish).[ Provide Type III Acoustical Ceiling Tiles containing a minimum of 30 percent recycled content. Provide data identifying percentage of recycled content for Type III ceiling tiles. Provide certification of indoor air quality for Type III Ceiling Tiles.]]

[IV (non-asbestos mineral fiber with membrane-faced overlay).[ Provide Type IV Acoustical Ceiling Tiles containing a minimum of 60 percent recycled content. Provide data identifying percentage of recycled content for Type IV ceiling tiles. Provide certification of indoor air quality for Type IV Ceiling Tiles.]]

[IX (mineral fiber with scrubbable finish).[ Provide Type IX Acoustical Ceiling Tiles containing a minimum of [50] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for Type IX ceiling tiles. Provide certification of indoor air quality for Type IX

Ceiling Tiles.]]

[X (mineral composition with plastic membrane).[ Provide certification of indoor air quality for Type X Ceiling Tiles.]]

[XI (mineral fiber with fabric faced overlay).[ Provide certification of indoor air quality for Type XI Ceiling Tiles.]]

[XII (fiberglass base with membrane-faced overlay).[ Provide Type XII Acoustical Ceiling Tiles containing a minimum of [25] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for Type XII ceiling tiles. Provide certification of indoor air quality for Type XII Ceiling Tiles.]]

#### 2.2.2.2 Flame Spread

Class A, 25 or less

#### 2.2.2.3 Pattern

[A] [B] [C] [D] [E] [F] [G] [I] [J] [K] [\_\_\_\_\_] ]

#### 2.2.2.4 Minimum NRC

[\_\_\_\_\_] when tested on mounting Type B or Type E-400 of [ASTM E795](#)

#### 2.2.2.5 Minimum Light Reflectance Coefficient

[LR-1, 0.75 or greater] [\_\_\_\_\_] ]

#### 2.2.2.6 Nominal Size

[12 by 12] [24 by 24] [24 by 48] [\_\_\_\_\_] inch

#### 2.2.2.7 Edge Detail

[Manufacturer's standard] [Beveled] [Square]

#### 2.2.2.8 Joint Detail

[Kerfed and rabbeted] [Tongue and grooved] [Butted]

#### 2.2.2.9 Finish

Factory-applied standard finish. See paragraph COLORS AND PATTERNS.

#### 2.2.2.10 Minimum CAC

[\_\_\_\_\_] ]

#### 2.2.3 Metal Pans [A] [\_\_\_\_\_] ]

##### 2.2.3.1 Type

[V, steel.[ Provide certification of indoor air quality for Type V Ceiling Tiles.]]

[VI, [ASTM A167](#) stainless steel.[ Provide certification of indoor air quality for Type VI Ceiling Tiles.]]



[VII, aluminum perforated pans with acoustical, non-asbestos, insulation backing. [ Provide certification of indoor air quality for Type VII Ceiling Tiles.]]

#### 2.2.3.2 Flame Spread

Class: A, 25 or less

#### 2.2.3.3 Pattern

[A] [C] [I] [\_\_\_\_\_]

#### 2.2.3.4 Minimum NRC

[0.75] [\_\_\_\_\_] in open office areas; [0.60] [\_\_\_\_\_] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; [0.50] [\_\_\_\_\_] in all other rooms and areas when tested on mounting Type E-400 of ASTM E795.

#### 2.2.3.5 Minimum Light Reflectance Coefficient

[LR-1, 0.75 or greater] [\_\_\_\_\_]

#### 2.2.3.6 Nominal Size

[24 by 24] [24 by 48] [\_\_\_\_\_] inch

#### 2.2.3.7 Edge Detail

[Manufacturer's standard] [Square] [Reveal] [\_\_\_\_\_].

#### 2.2.3.8 Joint Detail

[Beveled] [\_\_\_\_\_]

#### 2.2.3.9 Finish

Factory-applied standard finish. See paragraph COLORS AND PATTERNS.

#### 2.2.3.10 Pads

[Completely enclosed, of material and thickness required for acoustical and fire test ratings] [\_\_\_\_\_].

#### 2.2.4 Impact/Abrasion Resistant Units

##### 2.2.4.1 Type

Non-asbestos mineral composition with a hardened mineral surface and factory applied white paint finish. Provide a surface resistant to impact and abrasion. [ Provide certification of indoor air quality for Impact/Abrasion Resistant Ceiling Tiles.]

##### 2.2.4.2 Flame Spread

Class A, 25 or less

##### 2.2.4.3 Pattern

[\_\_\_\_\_]

2.2.4.4 Minimum NRC

[\_\_\_\_\_] when tested on Mounting Type E-400 of [ASTM E795](#).

2.2.4.5 Minimum Light Reflectance Coefficient

[LR-1, 0.75 or greater] [\_\_\_\_\_]

2.2.4.6 Nominal Size

[24 by 24] [24 by 48] [\_\_\_\_\_] inch

2.2.4.7 Edge Detail

[Manufacturer's standard] [Square] [Beveled]

2.2.4.8 Joint Detail

[Trimmed and butted] [Kerfed and rabbeted]

2.2.4.9 Finish

Factory-applied standard finish. See paragraph [COLORS AND PATTERNS](#).

2.2.5 Humidity Resistant Composition Units

2.2.5.1 Type

Non-asbestos mineral or glass fibers bonded with ceramic, moisture resistant thermo-setting resin, or other moisture resistant material and having a factory applied white paint finish. Provide panels that do not sag or warp under conditions of heat, high humidity or chemical fumes.

[Provide certification of [indoor air quality for Humidity Resistant Ceiling Tiles](#).]

2.2.5.2 Flame Spread

Class: A, 25 or less

2.2.5.3 Pattern

[\_\_\_\_\_]

2.2.5.4 Minimum NRC

[\_\_\_\_\_] when tested on Mounting Type E-400 of [ASTM E795](#).

2.2.5.5 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

2.2.5.6 Nominal Size

[24 by 24] [24 by 48] [\_\_\_\_\_] inch

## 2.2.5.7 Edge Detail

Square

## 2.2.5.8 Finish

Factory-applied standard finish. See paragraph COLORS AND PATTERNS.

## 2.2.6 Metal Faced Composition Units

## 2.2.6.1 Type

[Type V (Steel facings with non-asbestos mineral composition absorbent backing). [ Provide certification of [indoor air quality for Type V Ceiling Tiles.](#)]]

[Type VI (Stainless steel facings with non-asbestos mineral composition absorbent backing). [ Provide certification of [indoor air quality for Type VI Ceiling Tiles.](#)]]

[Type VII (Aluminum facings with non-asbestos mineral composition absorbent backing) with [anodized] [baked enamel] [acrylic] finish color [white] [\_\_\_\_\_]. [ Provide certification of [indoor air quality for Type VII Ceiling Tiles.](#)]]

## 2.2.6.2 Flame Spread

Class: A, flame spread 25 or less

## 2.2.6.3 Pattern

[\_\_\_\_\_]

## 2.2.6.4 Minimum (NRC)

Base the tested NRC value on Mounting Type E-400 of [ASTM E795](#).

## 2.2.6.5 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

## 2.2.6.6 Nominal Size

[24 by 24] [24 by 48] inch

## 2.2.6.7 Edge Detail

[Manufacturer's standard] [Square] [Beveled]

## 2.2.6.8 Joint Detail

Trimmed and butted

## 2.2.6.9 Finish

Factory-applied standard finish. See paragraph COLORS AND PATTERNS.

## 2.2.7 Unit Acoustical Absorbers

Provide individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with [ASTM C423](#) and reported as a 4 frequency average.

### 2.3 SUSPENSION SYSTEM

Provide [[standard] [fire-resistive] [snap-in metal pan]] [[[exposed-grid](#)] [[indirect hung concealed H and T or Zee](#)] [[direct hung, concealed, downward access](#)] [[direct hung, concealed, upward access](#)]] [[standard width flange] [narrow width flange] [narrow width slotted flange]] [as indicated] suspension system conforming to [ASTM C635/C635M](#) [for intermediate-duty systems] [for heavy-duty systems]. Provide surfaces exposed to view of [aluminum or steel with a factory-applied [white] [black] [color] baked-enamel finish] [aluminum with a clear anodized finish] [aluminum with colored factory-applied vinyl paint finish]. Provide wall molding having a flange of not less than [ [15/16 inch](#) ] [\_\_\_\_\_]. Provide [inside and outside corner caps] [[standard] [overlapped] [mitered] corners]. Provide a suspension system with a maximum deflection of 1/360 of the span length capable of supporting the finished ceiling, light fixtures, air diffusers, and accessories, as shown. [ Conform seismic details [to the guidance in [UFC 3-301-01](#) and [ASTM E580/E580M](#)] [as indicated].]

[Provide Suspension System containing a minimum of 15 percent recycled content. Provide data identifying percentage of [recycled content for suspension systems](#).]

### 2.4 HANGERS

Provide hangers and attachment capable of supporting a minimum [300 pound](#) ultimate vertical load without failure of supporting material or attachment.

#### 2.4.1 Wires

Conform wires to [[ASTM A641/A641M](#), Class 1, [[0.08 inch \(12 gauge\)](#)] [[\\_\\_\\_\\_\\_](#)] inch] in diameter.] [[ASTM A580/A580M](#), composition 302 or 304, condition annealed stainless steel, [[0.08 inch \(12 gauge\)](#)] [[\\_\\_\\_\\_\\_](#)] inch] in diameter.]

#### 2.4.2 Straps

Provide straps of [1 by 3/16 inch](#) galvanized steel conforming to [ASTM A653/A653M](#), with a light commercial zinc coating or [ASTM A1008/A1008M](#) with an electrodeposited zinc coating conforming to [ASTM B633](#), Type RS.

#### 2.4.3 Rods

Provide [3/16 inch](#) diameter threaded steel rods, zinc or cadmium coated.

#### 2.4.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with [ASTM A489](#). Provide minimum [\_\_\_\_\_] [[1/4](#)] inch, [zinc coated] [cadmium plated] eyebolts.

#### 2.4.5 Masonry Anchorage Devices

Comply with [[ASTM C636/C636M](#)] [\_\_\_\_\_] for anchorage devices for [eyebolts] [machine screws] [wood screws].

## 2.5 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 12 by 12 inch or more than 12 by 24 inch.

- a. Attach an identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.
- b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

- (1) Fire detection/alarm system
- (2) Air conditioning controls
- (3) Plumbing system
- (4) Heating and steam systems
- (5) Air conditioning duct system
- (6) Sprinkler system
- (7) Intercommunication system
- [ (8) Nurse's call system
- ] [ (9) Pneumatic tube system
- ] [ (10) Medical piping system
- ] (11) Program entertainment
- (12) Telephone junction boxes
- [ (13) Detector X-ray
- ] (14) [\_\_\_\_\_]

## 2.6 ADHESIVE

Use adhesive as recommended by tile manufacturer. [Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of

space type) or VOC content requirements of [GS-36](#). For products located on the interior of the building (inside of the weatherproofing system), provide certification or validation of [indoor air quality for adhesives.](#)]

## 2.7 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

## 2.8 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components [as specified in Section [09 06 00 SCHEDULES FOR FINISHES](#)] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers].

## 2.9 ACOUSTICAL SEALANT

Conform acoustical sealant to [ASTM C834](#), nonstaining. [Provide sealants used on the interior of the building (defined as inside of the weatherproofing system)] [in accordance with requirements of Section [07 92 00 JOINT SEALANTS.](#)] [that meet either emissions requirements of [CDPH SECTION 01350](#) (limit the requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). For products located on the interior of the building (inside of the weatherproofing system), provide certification of [indoor air quality for Sealants.](#)]

# PART 3 EXECUTION

## 3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

### 3.1.1 Suspension System

Install suspension system in accordance with [ASTM C636/C636M](#) and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

#### 3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

#### 3.1.1.2 Splayed Hangers

Splay (slope or slant) hangers around obstructions, offsetting the resulting horizontal force by bracing, countersplaying, or other acceptable means.

#### 3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

#### 3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

#### 3.1.4 Acoustical Sealant

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

#### 3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

### 3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

### 3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

### [3.4 RECLAMATION PROCEDURES

Neatly stack completely dry ceiling tile, designated for recycling by the

Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

] -- End of Section --



## SECTION 09 62 38

## STATIC-CONTROL FLOORING

08/17, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

- AATCC 16 (2004; E 2008; E 2010) Colorfastness to Light
- AATCC 107 (2013) Colorfastness to Water
- AATCC 165 (2013) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method

## ASTM INTERNATIONAL (ASTM)

- ASTM D5793 (2018) Standard Test Method for Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
- ASTM D5848 (2020) Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings
- ASTM D6859 (2011) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
- ASTM E648 (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- ASTM F150 (2006; R 2013) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
- ASTM F1344 (2021a) Standard Specification for Rubber Floor Tile
- ASTM F1700 (2020) Standard Specification for Solid Vinyl Floor Tile
- ASTM F1859 (2021a) Standard Specification for Rubber Sheet Floor Covering Without Backing
- ASTM F1861 (2021) Standard Specification for Resilient Wall Base
- ASTM F1869 (2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete

Subfloor Using Anhydrous Calcium Chloride

ASTM F2170

(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350

(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

CARPET AND RUG INSTITUTE (CRI)

CRI 104

(2015) Carpet Installation Standard for Commercial Carpet

CRI 105

(2015) Carpet Installation Standard for Residential Carpet

CRI Green Label Plus

(2017) Green Label Plus Quality Manual

ELECTROSTATIC DISCHARGE ASSOCIATION (ESD)

ESD S6.1

(2019) Standard for the Protection of Electrostatic Discharge Susceptible Items - Grounding

GREEN SEAL (GS)

GS-36

(2013) Adhesives for Commercial Use

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551

(2020) Textile Floor Coverings and Textile Floor Coverings in Tile Form- Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions and Distortion Out of Plane

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99

(2021; TIA 20-1) Health Care Facilities Code

RESILIENT FLOOR COVERING INSTITUTE (RFCI)

FLOORSCORE

FLOORSCORE IAQ Certification

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS

SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168

(2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SCHEDULING

Schedule static-control flooring work after any other work which would damage the finished surface of the flooring.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-03 Product Data

- Static-Control Resilient Flooring; G[, [\_\_\_\_\_]]
- [ Recycled content for Conductive Vinyl Tile; S]
- [ Recycled content for Conductive Rubber Tile; S]
- [ Recycled content for Conductive Rubber Sheet Flooring; S]
- [ Recycled content for Static-Dissipative Vinyl Tile; S]
- [ Recycled content for Static-Control Carpet; S]
- Accessories; G[, [\_\_\_\_\_]]
- Adhesives; G[, [\_\_\_\_\_]]
- Warranty

## SD-04 Samples

- Static-Control Resilient Flooring; G[, [\_\_\_\_\_]]
- Static-Control Carpet; G[, [\_\_\_\_\_]]
- Moldings; G[, [\_\_\_\_\_]]
- Special Treatment Materials; G[, [\_\_\_\_\_]]
- Accessories; G[, [\_\_\_\_\_]]

## SD-06 Test Reports

- Fire Resistance
- Moisture, Alkalinity and Bond
- Testing

## SD-07 Certificates

- [ Indoor Air Quality for Conductive Vinyl Tile; S]
- [ Indoor Air Quality for Conductive Rubber Tile; S]
- [ Indoor Air Quality for Conductive Rubber Sheet Flooring; S]
- [ Indoor Air Quality for Static-Dissipative Vinyl Tile; S]
- [ Indoor Air Quality for Static-Dissipative Rubber Tile; S]
- [ Indoor Air Quality for Static-Control Carpet; S]
- [ Indoor Air Quality for Adhesives; S]

## Qualifications of Applicator

## SD-08 Manufacturer's Instructions

- Static-Control Resilient Flooring; G[, [\_\_\_\_\_]]
- Accessories; G[, [\_\_\_\_\_]]

## SD-10 Operation and Maintenance Data

- Static-Control Resilient Flooring; G[, [\_\_\_\_\_]]
- Accessories; G[, [\_\_\_\_\_]]

## 1.3.1 Samples

## 1.3.1.1 Static-Control Resilient Flooring

Submit [three][\_\_\_\_\_] samples of each indicated color and type of flooring, base, moldings, and accessories sized a minimum 2-1/2 by 4 inch.

## 1.3.1.2 Static-Control Carpet

Submit [three][\_\_\_\_\_] "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

## 1.3.1.3 Moldings

Submit [three][\_\_\_\_\_] pieces of each type at least 12 inches long.

## 1.3.1.4 Special Treatment Materials

Submit [three][\_\_\_\_\_] samples showing system and installation method.

## 1.3.1.5 Operations and Maintenance Data

- a. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.
- b. Submit [three][\_\_\_\_\_] copies of manufacturer's maintenance instructions for each type of flooring material describing recommended type of

cleaning equipment and materials, spotting and cleaning methods, and cleaning cycles.

#### 1.4 CERTIFICATIONS

##### 1.4.1 Indoor Air Quality Certifications

###### 1.4.1.1 Floor Covering Materials

Provide [Conductive Vinyl Tile] [Conductive Rubber Tile] [Conductive Rubber Sheet Flooring] [Static-Dissipative Vinyl Tile] [Static-Dissipative Rubber Tile] and wall base products certified to meet indoor air quality requirements by [FLOORSCORE](#), [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide [Static-Control Carpet] certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#), [CRI Green Label Plus](#) or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.

###### 1.4.1.2 Adhesives

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body.

#### 1.5 EXTRA MATERIALS

Provide extra material from same dye lot for future maintenance. Provide a minimum of [\_\_\_\_\_] percent of total [square yards](#) of each flooring and base type, pattern, and color.

#### 1.6 QUALITY ASSURANCE

The flooring manufacturer will approve the [Qualifications of Applicator](#) and certify that he/she has a minimum of 3 years of experience in the application of the materials to be used.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, size, production run, project identification, handling instructions and related information. Observe ventilation and safety procedures specified in the Safety Data Sheets (SDS). Do not store flooring near materials that may off-gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

##### 1.7.1 Static-Control Resilient Flooring

Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature range as recommended by the manufacturer but not less than 68 degrees F or more than 85 degrees F. Stack materials according to manufacturer's recommendations. Protect materials from the direct flow of heat from

hot-air registers, radiators and other heating fixtures and appliances.

#### 1.7.2 Static-Control Carpet

Remove materials from packaging and store them in a clean, dry, well ventilated area protected from damage, soiling, and moisture, and maintain at a temperature range as recommended by the manufacturer but not less than 60 degrees F or more than 90 degrees F for 2 days prior to installation.

#### 1.8 ENVIRONMENTAL CONDITIONS

Provide temporary ventilation during work of this section.

##### 1.8.1 Static-Control Resilient Flooring

Maintain areas in which resilient flooring is to be installed at a temperature range as recommended by the manufacturer but not less than 68 degrees F or more than 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature range as recommended by the manufacturer but not less than 55 degrees F thereafter for the duration of the contract. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

##### 1.8.2 Static-Control Carpet

Maintain areas in which carpeting is to be installed at a temperature range as recommended by the manufacturer but not less than 60 degrees F or more than 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Maintain a minimum temperature range as recommended by the manufacturer but not less than 55 degrees F thereafter for the duration of the contract. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation.

#### 1.9 WARRANTY

##### 1.9.1 Static-Control Resilient Flooring

Provide manufacturer's standard performance guarantees or warranties including a five year wear warranty and ten year conductivity warranty.

##### 1.9.2 Static-Control Carpet

Provide manufacturer's standard performance guarantees or warranties including a minimum two years for material and workmanship and ten years for wear, static control, tuft bind and delamination.

### PART 2 PRODUCTS

#### 2.1 STATIC-CONTROL RESILIENT FLOORING

##### 2.1.1 Conductive Resilient Flooring

###### 2.1.1.1 Conductive Vinyl Tile

Conductive vinyl tile must be a homogeneous vinyl product and conform to ASTM F1700. Provide electrical resistance from surface to surface and surface to ground between 25,000 ohms (2.5 x 10 to the 4th) and 1,000,000

ohms (1.0 x 10 to the 6th) when tested in accordance with ASTM F150. Tile must be [12] [24] [36] [\_\_\_\_\_] inches square and 1/8 inch thick. [ Tile must be pre-grooved for heat welding of seams. As required, provide welding rods as recommended by the manufacturer.]

[Provide Conductive Vinyl Tile containing a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for Conductive Vinyl Tile.]

[Provide certification of indoor air quality for Conductive Vinyl Tile.]

#### 2.1.1.2 Conductive Rubber Tile

Provide conductive rubber tile conforming to ASTM F1344 Class 1 homogeneous, Type B (through mottled) with a [smooth] [ or ] [hammered] surface. Provide electrical resistance from surface to surface and surface to ground between 25,000 ohms (2.5 x 10 to the 4th) and 1,000,000 ohms (1.0 x 10 to the 6th) when tested in accordance with ASTM F150. Provide tile [24] [\_\_\_\_\_] inches square and [2.0] [\_\_\_\_\_] mm thick.

[Provide Conductive Rubber Tile containing a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for Conductive Rubber Tile.]

[Provide certification of indoor air quality for Conductive Rubber Tile.]

#### 2.1.1.3 Conductive Rubber Sheet Flooring

Provide conductive rubber sheet flooring conforming to ASTM F1859 (flooring without backing), Type I homogeneous. Provide electrical resistance from surface to surface and surface to ground between 25,000 ohms (2.5 x 10 to the 4th) and 1,000,000 ohms (1.0 x 10 to the 6th) when tested in accordance with ASTM F150. Provide tile [4] [\_\_\_\_\_] feet wide and [2.0] [\_\_\_\_\_] mm thick.

[Provide Conductive Rubber Sheet Flooring containing a minimum of 5 percent recycled content. Provide data identifying percentage of recycled content for Conductive Rubber Sheet Flooring.]

[Provide certification of indoor air quality for Conductive Rubber Sheet Flooring.]

### 2.1.2 Static-Dissipative Resilient Flooring

#### 2.1.2.1 Static-Dissipative Vinyl Tile

Static-dissipative vinyl tile must be a homogeneous vinyl product and conform to ASTM F1700. Provide electrical resistance from surface to surface and surface to ground between 1,000,000 ohms (1.0 x 10 to the 6th) and 1,000,000,000 ohms (1.0 x 10 to the 9th) when tested in accordance with ASTM F150. Tile must be [12] [24] [36] [\_\_\_\_\_] inches square and 1/8 inch thick. [ Tile must be pre-grooved for heat welding of seams. As required, provide welding rods as recommended by the manufacturer.]

[Provide Static-Dissipative Vinyl Tile containing a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for Static-Dissipative Vinyl Tile.]

[Provide certification of indoor air quality for Static-Dissipative Vinyl

Tile.]

#### 2.1.2.2 Static-Dissipative Rubber Tile

Static-dissipative rubber tile conforming to [ASTM F1344](#) Class 1 homogeneous, [Type A (solid color)] [Type B (through mottled)]. Provide a [smooth] [hammered] surface. Provide electrical resistance from surface to surface and surface to ground between 1,000,000 ohms (1.0 x 10 to the 6th) and 1,000,000,000 ohms (1.0 x 10 to the 9th) when tested in accordance with [ASTM F150](#). Provide tile [18] [24] [36] [\_\_\_\_\_] inches square and [2.0] [3.5] [\_\_\_\_\_]mm thick.

[Provide certification of indoor air quality for Static-Dissipative Rubber Tile.]

### 2.2 STATIC-CONTROL CARPET

Provide first quality carpet; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably non-allergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance.

[Provide Static Control Carpet containing a minimum of 40 percent recycled content. Provide data identifying percentage of recycled content for Static-Control Carpet.]

[Provide certification of indoor air quality for Static-Control Carpet.]

#### 2.2.1 Physical Characteristics

##### 2.2.1.1 Carpet Construction

Tufted

##### 2.2.1.2 Type

Modular tile [24 by 24] [\_\_\_\_\_] inch square with 0.15 percent growth/shrink rate in accordance with [ISO 2551](#).

##### 2.2.1.3 Pile Type

[Level-loop] [Multilevel loop] [\_\_\_\_\_] ]

##### 2.2.1.4 Pile Fiber

Commercial 100 percent branded (federally registered trademark) nylon continuous filament

##### 2.2.1.5 Conductive Fiber

Provide a continuous conductive fiber as recommended by the manufacturer in every tuft.

##### 2.2.1.6 Gauge

Minimum [\_\_\_\_\_] inch in accordance with [ASTM D5793](#).



## 2.2.1.7 Stitches

Minimum [\_\_\_\_\_] per square inch

## 2.2.1.8 Surface Pile Weight

Minimum [\_\_\_\_\_] ounces per square yard. This does not include weight of backings. Determine weight in accordance with [ASTM D5848](#).

## 2.2.1.9 Pile Thickness

Minimum [\_\_\_\_\_] inch in accordance with [ASTM D6859](#).

## 2.2.1.10 Pile Density

Minimum [\_\_\_\_\_]

## 2.2.1.11 Dye Method

[Solution dyed] [\_\_\_\_\_]

## 2.2.1.12 Backing System

Provide conductive backing system of synthetic material as recommended by the carpet manufacturer.

## 2.2.2 Static-Control Carpet Performance Requirements

## 2.2.2.1 Electrical Resistance

Provide electrical resistance from surface to surface and surface to ground between [25,000 ohms (2.5 x 10 to the 4th) and 100,000,000 ohms (1.0 x 10 to the 8th) ohms] [\_\_\_\_\_] when tested in accordance with [NFPA 99](#).

## 2.2.2.2 Tuft Bind

Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 10 pound average force for loop pile.

## 2.2.2.3 Colorfastness to Crocking

Comply dry and wet crocking with [AATCC 165](#) and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

## 2.2.2.4 Colorfastness to Light

Comply colorfastness to light with [AATCC 16](#), Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

## 2.2.2.5 Colorfastness to Water

Comply colorfastness to water with [AATCC 107](#) and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

## 2.2.2.6 Delamination Strength

Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

## 2.3 WALL BASE

### 2.3.1 Resilient Base

Resilient base must conform to [ASTM F1861](#), [[Type TS (vulcanized thermoset rubber)][,][ or ][Type TP (thermoplastic rubber)]] [ , or ][Type TV (thermoplastic vinyl)], [Style A (straight - installed with carpet)][,][ and ][ Style B (coved - installed with resilient flooring)]. Provide [4](#) [6](#) inch high and a minimum [1/8](#) inch thick wall base. Provide [preformed][job formed] corners in matching height, shape, and color.

### 2.3.2 Self-Coving

Self-coving must consist of static-control resilient flooring over a cove stick and must have [cove cap][ and metal corner] as recommended by the manufacturer of the flooring. Self-coving base material must be same as floor material.

## 2.4 ADHESIVES

Provide conductive adhesive as recommended by the manufacturer of the static-control flooring [and self-coving base]. Provide conductive adhesive for carpet tile that is also releasable as recommended by the manufacturer. Provide adhesive for wall base as recommended by the wall base manufacturer.

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [GS-36](#). Provide certification or validation of [indoor air quality for adhesives](#).

## 2.5 MOLDINGS

Provide heavy duty tapered moldings of [[vinyl][ or ][rubber]] [[\_\_\_\_]-colored anodized aluminum][clear anodized aluminum] and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on molding of maximum [1/4](#) inch. Provide bevel change in level between [1/4](#) and [1/2](#) inch with a slope no greater than 1:2. Provide [\_\_\_\_] color to match [resilient base][\_\_\_\_].

## 2.6 ACCESSORIES

Use accessories recommended by the manufacturer of the flooring.

## 2.7 ELECTRICAL GROUND CONNECTION

Provide an electrical ground connection that meets the requirements of [ESD S6.1](#). Connection between the static-control floor system and the external grounding system must be provided. Contact with the static-control floor system must be with conductive grounding strip and must have the greater of the following: a minimum contact area of [9 square inch](#) or the dimensions recommended by the manufacturer. Provide the

grounding conductor recommended by the manufacturer of the flooring. Connect and install the grounding conductor as recommend by the flooring manufacturer.

## 2.8 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES][as indicated][\_\_\_\_\_]. Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern.

## 2.9 FIRE RESISTANCE TESTING REQUIREMENTS

Provide a minimum average critical radiant flux of [0.22][0.45] watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E648.

# PART 3 EXECUTION

## 3.1 SURFACE PREPARATION

Before any work under this section is begun, defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces must be corrected, and damaged portions of concrete slabs must be repaired in accordance with flooring manufacturer's recommended instructions. Floor must be in a level plane with a maximum variation of 1/8 inch every 10 feet, except where indicated as sloped. Repair cracks and irregularities and prepare the subfloor in accordance with flooring manufacturer's recommended instructions. Curing and sealing compounds should not be used on concrete surfaces to receive flooring unless they have been tested and approved by the flooring manufacturer. In addition, remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions. If a curing compound is required, it must be coordinated for compatibility with the flooring adhesive.

## 3.2 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with ASTM F1869 or ASTM F2170, unless otherwise recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations.

## 3.3 GENERAL INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

## 3.4 INSTALLATION OF STATIC-CONTROL RESILIENT TILE FLOORING

Install static-control resilient flooring, ground connections[, heat welded joints,] and accessories in accordance with the approved manufacturer's installation instructions. Tile lines and joints must be kept square, symmetrical, tight, and even. Tile at the perimeter of the area to be finished may vary as necessary to maintain full-size tiles in the field,

but no perimeter tile may be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Tile must be cut, fitted, and scribed to walls, partitions, and projections after field flooring has been applied. Install grounding strips in accordance with manufacturer's installation instructions. Protect edges of flooring material meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions.

### 3.5 INSTALLATION OF STATIC-CONTROL RESILIENT SHEET FLOORING

Install static-control resilient sheet flooring, ground connections[, heat welded joints] and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Lay out sheets to minimize waste. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied. Finish joints flush, free from voids, recesses, and raised areas. Install grounding strips in accordance with manufacturer's installation instructions. Protect edges of flooring material meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. [ Install flooring with an integral coved base.]

### 3.6 INSTALLATION OF STATIC-CONTROL CARPET

Install static-control carpet, ground connections and accessories in accordance with the approved manufacturer's installation instructions and CRI 104/CRI 105. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Install modular tiles with [release] [\_\_\_\_\_] adhesive and join together snugly. Lay tiles in [the same direction] [an alternating pattern] with accessibility to the subfloor where required. Install grounding strips in accordance with manufacturer's installation instructions.

### 3.7 INSTALLATION OF WALL BASE

#### 3.7.1 Resilient Base

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

#### 3.7.2 Self-Coving

The static-control resilient flooring must have a self-coving base and must be installed in accordance with the flooring manufacturer's printed installation instructions. Extend the self-cove up the walls, columns and pilasters [4] [6] inches. Terminate the coving with a cove cap. Place a cove stick at the floor-wall junction to support the coving at the bend.

Provide self-cove [at room perimeter and at fixed vertical interruptions to the flooring] [as indicated]. [Provide protective metal corners at outside and inside corners.]

### 3.8 CLEANING AND PROTECTION

The flooring must be cleaned in accordance with the manufacturer's recommendations. Flooring must be protected by a covering of heavy-duty building paper before foot traffic is permitted. Lap and secure edges of kraft paper protection to provide a continuous cover. Boardwalks must be placed over flooring in areas where subsequent building operations might damage the floor. Remove and replace flooring that becomes loose, broken, or curled prior to acceptance, or flooring that does not conform to resistance requirements of [ASTM F150](#).

### 3.9 TESTING

Test the flooring in accordance with and conform to the requirements of [ESD S6.1](#).

-- End of Section --

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## SECTION 09 64 66

## WOOD ATHLETIC FLOORING

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

**AWPA C1** (2003) All Timber Products - Preservative Treatment by Pressure Processes

**AWPA C2** (2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

**AWPA M4** (2021) Standard for the Care of Preservative-Treated Wood Products

## ASTM INTERNATIONAL (ASTM)

**ASTM A36/A36M** (2019) Standard Specification for Carbon Structural Steel

**ASTM C208** (2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board

**ASTM D41/D41M** (2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

**ASTM D226/D226M** (2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

**ASTM D395** (2016; E 2017) Standard Test Methods for Rubber Property - Compression Set

**ASTM D412** (2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

**ASTM D449/D449M** (2003; R 2014; E 2014) Asphalt Used in Dampproofing and Waterproofing

**ASTM D1622/D1622M** (2014) Apparent Density of Rigid Cellular

## Plastics

ASTM D2103	(2015) Standard Specification for Polyethylene Film and Sheeting
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM E96/E96M	(2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM F36	(2015; R 2021) Standard Test Method for Compressibility and Recovery of Gasket Materials

## CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120	(2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products
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## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## CARPET AND RUG INSTITUTE (CRI)

CRI GL CUSHION	Green Label Cushion Program
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## CSA GROUP (CSA)

CSA Z809-08	(R2013) Sustainable Forest Management
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## FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship
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## MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)

MFMA AFSFSL	(2016) Athletic Floor Sealer and Finish Specifications and Conformance List #35
MFMA GRHM	(2000) Grading Rules for MFMA Northern Hardwood Maple
MFMA SSCLFMGF	(2016) Sanding, Sealing, Court Lining, Finishing and Resurfacing of Maple Gym Floors

## PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013	(2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements
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RESILIENT FLOOR COVERING INSTITUTE (RFCI)

FLOORSCORE FLOORSCORE IAQ Certification

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113 (2016) Architectural Coatings

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

SUSTAINABLE FOREST INITIATIVE (SFI)

SFI 2015-2019 (2015) Standards, Rules for Label Use, Procedures and Guidance

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770 Formaldehyde Standards for Composite Wood Products

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Hardwood Strip Flooring System

Clearly delineate components of the system. Show layout of [sleepers] [steel channels] [steel spines]; location of anchor plate assemblies, floor outlets, and underfloor conduit or raceway location; flooring system details; and flooring abutting other construction. Accessories shall be approved by the flooring manufacturer.

### SD-03 Product Data

#### Hardwood Strip Flooring Components

Indoor Air Quality for Asphalt Fill; S

Indoor Air Quality for Asphalt Primer; S

Indoor Air Quality for Asphalt Mastic; S

Indoor Air Quality for Seal Coat and Finish Coat Materials; S

Indoor Air Quality for Game Line Marking Materials; S

Indoor Air Quality for Adhesives; S

SD-04 Samples

Strip Flooring; G[, [\_\_\_\_\_]]

Hardwood Base; G[, [\_\_\_\_\_]]

Molded-Rubber Base; G[, [\_\_\_\_\_]]

Steel Channels and Clips

[ Fiberboard Underlayment

] [ Flexible Foam Underlayment

] Cushions and Pads

Corkboard or Corkroll

Sleepers and Nailers

SD-06 Test Reports

Preservative Treatment

SD-07 Certificates

Certified Sustainably Harvested Wood Strip Flooring; S

[ Certified Sustainably Harvested Sleepers and Nailers; S

] [ Certified Sustainably Harvested Wood Board Subflooring; S

] [ Certified Sustainably Harvested Plywood Subflooring; S

] [ Indoor Air Quality for Wood Strip Flooring; S

] Indoor Air Quality for Molded-Rubber Base; S

[ Indoor Air Quality for Fiberboard Underlayment; S

] Indoor Air Quality for Rubber Cushions and Pads; S

[ Indoor Air Quality for Flexible Foam Underlayment; S

] SD-08 Manufacturer's Instructions

Flooring System

Adhesive for Membrane Installation

Submit flooring system manufacturer's installation

instructions. Submit vaporproofing manufacturer's written recommendations for adhesives to be used in membrane installation.

#### SD-10 Operation and Maintenance Data

Hardwood [Strip Flooring](#), Data Package 1; G[, [\_\_\_\_\_]]

### 1.3 CERTIFICATION

#### 1.3.1 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by [FSC STD 01 001](#)[, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019](#), or other third party program certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

#### 1.3.2 Indoor Air Quality Certification

Submit required indoor air quality certifications in one submittal package.

##### 1.3.2.1 Floor Covering Materials

Provide wood strip flooring and molded rubber base products certified to meet indoor air quality requirements by [FLOORSORE](#), [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide rubber cushions and pads, and flexible foam underlayment products certified to meet indoor air quality requirements by [FLOORSORE](#), [UL 2818](#) (GreenGuard) Gold, [SCS Global Services Indoor Advantage Gold](#), [CRI GL CUSHION](#) or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

##### [1.3.2.2 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Provide products certified to meet requirements of both [40 CFR 770](#) and [CARB 93120](#). Provide current product certification documentation from certification body.

### ]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened packages, bundles, or containers. Protect materials against dampness during shipment and after delivery. Store material under cover in a well-ventilated building. Prevent exposure to extreme changes of temperature and humidity. Do not store materials in building under construction until wet-applied building materials are dry. Store flooring in accordance with [MFMA GRHM](#), under adequate and controlled ventilation and under approved temperature and humidity conditions at the location where it is to be laid for at least seven days before installation. Handle and store preservative-treated

materials in accordance with **AWPA M4**.

## 1.5 ENVIRONMENTAL CONDITIONS

For at least one week prior to and during installation, in the location to receive finish flooring and the location where flooring will be stored, maintain a temperature of between **65 and 80 degrees F**, and a relative humidity of between 40 and 60 percent. When the interior relative humidity exceeds 60 percent during or after installation of flooring, sanding and finishing of flooring shall be delayed for two to three weeks after completion of laying, unless directed otherwise. Provide adequate ventilation during the entire sealing and finishing process to ensure that no unhealthy or hazardous accumulation of vapors occurs. Ensure that environmental conditions are met.

## PART 2 PRODUCTS

### 2.1 **HARDWOOD STRIP FLOORING SYSTEMS ON CONCRETE SLAB**

#### [2.1.1 Clipped to Steel Channels on Underlayment

Provide flooring system consisting of hardwood strip flooring clipped to steel channels that rest in premilled grooves in [fiberboard] [flexible foam] underlayment. Anchor steel channels to concrete floor slab.

#### ] [2.1.2 Wood Sleepers with Rubber Cushions

Provide flooring system consisting of hardwood strip flooring nailed to wood sleepers that are seated on rubber cushions resting on the concrete floor slab.

#### ] [2.1.3 Wood Board Subflooring, Wood Nailers, and Asphalt Fill

Provide flooring system consisting of hardwood strip flooring nailed to wood board subflooring that is, in turn, nailed to shimmed wood nailers anchored to the concrete floor slab. Provide hot asphalt fill under and between the wood nailers.

#### ] [2.1.4 Plywood Subflooring with Rubber Pads

Provide flooring system consisting of hardwood strip flooring nailed to two-layer plywood subflooring that is seated on cushioned pads resting on the concrete floor slab.

#### ] [2.1.5 Steel-Splined, Continuous Unit, [on Cork Underlayment]

Provide flooring system consisting of uniform lengths of hardwood strip flooring interlocked with steel splines and laid in asphalt mastic [on cork underlayment which is laid in asphalt mastic over membrane of felt] on the concrete floor slab.

#### ] 2.2 MATERIALS

##### 2.2.1 **Strip Flooring**

Second or better grade [hard maple] [beech or birch] graded in accordance with current **MFMA GRHM**. Flooring must be [25/32] [33/32] [\_\_\_\_\_] inch thick by [2 1/4] [1 1/2] inches or narrower on the face, kiln dried, continuous tongue-and-groove, and end-matched. Provide wood products with

no added urea-formaldehyde resins. Each bundle of flooring must be clearly grade stamped. Moisture content of strip flooring must not exceed 8 percent at time of arrival on job site and must be allowed to acclimate in accordance with paragraph DELIVERY, STORAGE, AND HANDLING. [ Flooring for steel-splined systems must be edge-grain 33/32 inch thick by 1 5/16 inch on the face, kiln-dried, continuous tongue-and-groove, and end grooved.] Provide certified sustainably harvested wood strip flooring.

[ Products must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for wood strip flooring.

#### ]2.2.2 Hardwood Base

Clear [hard maple] [beech or birch]. Provide shape and size of base as indicated or as recommended by the flooring manufacturer.

#### 2.2.3 Molded-Rubber Base

4 inch vertical leg by 3 inch, designed to allow ventilation under floor [with premolded outside corners and mitered inside corners], and as recommended by flooring manufacturer. Products must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for molded-rubber base.

#### 2.2.4 Steel Angle Base

Provide 3 by 3 by 3/16 inch continuous steel angle along perimeter walls, designed to allow ventilation under the floor. Base angle must conform to ASTM A36/A36M.

#### 2.2.5 Steel Channels and Clips

Provide channels and clips not less than 16 gage zinc-coated steel.

#### [2.2.6 Fiberboard Underlayment

ASTM C208, fiberboard insulation board, impregnated with asphalt or coated with asphalt on faces and edges, treated for termite and water resistance. Products must contain no added urea-formaldehyde resins. Provide certification of indoor air quality for fiberboard underlayment.

#### ]2.2.7 Rubber Cushions and Pads

Rubber cushions and pads must have a durometer hardness of A50, plus or minus 5, when tested in accordance with ASTM D2240 and must have a minimum tensile strength of 1500 psi, when tested in accordance with ASTM D412. When subjected to an aging period of 70 hours and exposed to a temperature of 158 degrees F, allowed to cool to room temperature over a period of 4 hours and retested, tested specimen must have a change in hardness of 10 points maximum, a change in tensile strength of minus 25 percent maximum and a change in ultimate elongation of minus 25 percent maximum in accordance with the applicable test methods referenced above. Test rubber cushions, under a load of 40 psi, in accordance with ASTM D395, Method A. Size of tested specimen must be 2 1/4 by 3 by 3/8 inch. Length of testing time must be 22 hours; temperature of test must be 158 degrees F. Test specimen must recover, without set or displacement. Products must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for rubber cushions and pads.

#### [2.2.8 Flexible Foam Underlayment

Multicellular, closed cell flexible polyethylene plastic foam having smooth skin; density 1.7 to 3.3 pounds per cubic foot when tested by [ASTM D1622/D1622M](#). Foam must be 1/2 inch thick by 48 inches wide by manufacturer's standard length, premilled to receive steel channels at 12 inch centers. Products must meet emissions requirements of [CDPH SECTION 01350](#). Provide certification or validation of [indoor air quality for flexible foam underlayment](#).

#### ]2.2.9 Polyethylene Vaporproofing Membrane

[ASTM D2103](#) Type 21110. Minimum thickness shall be 6 mils. Perm rating must not exceed 0.02 when tested in accordance with [ASTM E96/E96M](#).

#### 2.2.10 Asphalt Primer

[ASTM D41/D41M](#). Provide asphalt primer products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for asphalt primer](#).

#### 2.2.11 Asphalt Mastic

As recommended by the flooring manufacturer. Provide asphalt mastic products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide validation of [indoor air quality for asphalt mastic](#).

#### 2.2.12 Asphalt Fill

[ASTM D449/D449M](#), Type I. Provide asphalt fill material products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for asphalt fill](#).

#### 2.2.13 Felt

[ASTM D226/D226M](#), type I, asphalt-saturated organic felt.

#### 2.2.14 Building Paper

Water-vapor permeable, 20 lb per inch dry tensile strength.

#### 2.2.15 Sleepers and Nailers

Surfaced on four sides, 2 by 3 inches nominal size, Standard or No. 2 grade douglas fir, northern or western and west coast hemlock, engleman-spruce or No. 2 dimension southern pine. Moisture content must not exceed 15 percent. Provide [preservative treatment](#) in accordance with [[AWPA C1](#)] [[AWPA C2](#)]. Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standard Committee. Brush coat exposed areas that are cut or drilled after treatment with the same preservative in accordance with [AWPA M4](#). [ Provide [certified sustainably harvested sleepers and nailers](#).]

### 2.2.16 Wood Board Subflooring

No. 2 common douglas fir, northern or western hemlock, englemann spruce, or southern pine No. 2 boards, northern red or Norway pine, surfaced on four sides. Nominal sizes must be 1 by 6 inches or 1 by 4 inches. Moisture content must not exceed 15 percent. [ Provide [certified sustainably harvested wood board subflooring](#).]

### 2.2.17 Plywood Subflooring

Douglas fir, southern pine, or western larch plywood; grade C-D, with exterior glue; 1/2 inch thick by 4 by 8 feet. [ Provide [certified sustainably harvested plywood subflooring](#).]

### 2.2.18 Sealing and Finishing for Hardwood Strip Flooring

Conform to [MFMA AFSFSCCL](#), Group [II] [III] finish. Seal coat and finish coat materials must be compatible with each other. Provide seal coat and finish coat products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for seal coat and finish coat materials](#).

### 2.2.19 Game Line Marking Materials

As recommended by wood flooring finish manufacturer. Provide game line marking products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for game line marking materials](#).

### 2.2.20 Nails

Shape and size as recommended by flooring manufacturer.

### 2.2.21 Underlayment

[Corkboard or corkroll](#), 1/2 inch thick, conforming to [ASTM F36](#).

### 2.2.22 Adhesives

Waterproof, suitable for use with molded rubber base, recommended by rubber base manufacturer. Provide adhesive products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide validation of [indoor air quality for adhesives](#).

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Condition of Subfloors

Do not install flooring on surfaces that are not suitable for proper installation. Before beginning work under this section, correct defects such as rough or scaling concrete, low spots, high spots, uneven surfaces, and repair damaged portions of concrete slabs. Concrete slabs must be given a leveling course of latex fill and the surface shall not vary more

than 1/8 inch when measured with a 10 foot straightedge placed in any direction.

### 3.1.2 Preparation of Concrete Slab

Sweep concrete floor. Ensure that slab is dry and clean. Remove paint spots, plaster, masonry droppings, grease, dirt, and other foreign matter [including chemical curing agents which may affect the bond of adhesive-applied wood flooring systems]. Concrete must be fully cured and dry.

### 3.1.3 Anchor Plate Assemblies for Portable Sports Equipment

Floor anchor plate assemblies for vertically adjustable portable sports equipment shall be installed where indicated. Flooring must be cut neatly around floor plates.

### 3.1.4 Work of Other Trades

Do not start work specified under this section until work of trades which could create moisture, has been completed.

### 3.1.5 Moisture Content

Check flooring, subflooring, sleepers and nailers with an approved meter verifying conformance with the requirements specified hereinbefore.

## 3.2 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

### 3.2.1 Vaporproofing For Slabs on Grade

Cover slab with the polyethylene membrane. Lap joints at least 6 inches. Seal joints with a full coverage of the adhesive recommended by the membrane manufacturer.

### 3.2.2 Flooring Clipped to Steel Channels

#### 3.2.2.1 Channel Placing

Install each channel in premilled grooves spaced 12 inches on center in [fiberboard] [flexible foam] parallel to the short side of the room, with butted end-to-end joints staggered at least 24 inches. Anchor channels to the slab at 14 inches on center with 3/8 inch diameter, flat headed anchors that penetrate the slab by at least 1-1/4 inches. Set channels level.

#### 3.2.2.2 Laying of Finished Flooring

Lay finished flooring at right angles to the steel channels. Begin installation with double-tongue strips of flooring in center of room. Clip each board down tightly at each channel intersection with zinc-coated flooring clips. Each clip must firmly engage the side edges of the flooring and the steel channels. Ensure that each clip is placed properly. Stagger adjacent end joints of flooring so that there will be at least two boards between joints. Where floor plates occur, install steel channels along edges of flooring board; provide clips for flooring. Drive each flooring strip up sideways and endways as tightly as practicable using



steel driving tools that prevent marring of exposed flooring. Scribe boards to permanent obstructions and be securely blocked at wall lines.

### 3.2.3 Flooring on Wood Sleepers with Rubber Cushions

#### 3.2.3.1 Installation of Wood Sleepers With Rubber Cushions

Install rubber-cushioned wood sleepers, [12 inches on center for 33/32 inch ] [9 inches on center for 25/32 inch] thick flooring, parallel to short side of the room, with butted end-to-end joints, 1/4 inch apart at the joints, staggered at least 24 inches. Sleepers must have the rubber cushions attached at 12 inch centers. Provide a 2 inch air space between ends and sides of sleepers at walls and other permanent obstructions. Sleepers must be seated level and firm with rubber cushions bearing completely on the subfloor. [ In areas where fixed or temporary seats are indicated, provide 1-5/8 by 1-7/8 inch wood screeds midway between the cushioned wood sleepers.]

#### 3.2.3.2 Laying of Finished Flooring

Begin installation of flooring in center of space with double-tongue strips of flooring. Lay flooring at right angles to the wood sleepers. Blind nail each strip of flooring to each wood sleeper with 8 penny spiral screw nails. Leave a continuous air space, 2 inches wide, between the finished flooring and perimeter walls and other permanent obstructions. Stagger end joints of adjacent strips of flooring so that there will be at least two boards between each joint.

### 3.2.4 Flooring on Board Subflooring, Wood Nailers, and Asphalt Fill

#### 3.2.4.1 Priming of Concrete Slab

Prime slab with asphalt primer using minimum of one gallon per 250 square feet. Allow primer to dry.

#### 3.2.4.2 Wood Nailers

Install continuous 2 by 3 inch nominal size wood nailers 12 inches on center, parallel to short side of room, with butted end-to-end staggered joints, 1/4 inch apart at the joints. Elevate bottoms of nailers about 3/16 inch above concrete slab with fiber shims. Fasten nailers to slab with 1/4 by 3 1/2 inch power driven anchors spaced 30 inches on center and staggered in adjacent rows. Provide an additional anchor not more than 6 inches from the end of each nailer. Provide a 2 inch air space between ends and sides of sleepers at walls and other permanent obstructions. Nailers must be set level and in alignment. Check level of tops of nailers with a surveyor's instrument.

#### 3.2.4.3 Asphalt Fill

When the wood nailers have been set and leveled, pour the hot asphalt over the entire concrete slab surface; fill the spaces under the wood nailers completely and cover the concrete slab surface between the nailers to a depth of approximately 3/8 to 1/2 inch. Pour asphalt up 1/4 inch on the sides of the nailers.

#### 3.2.4.4 Wood Board Subflooring

Apply wood subflooring diagonally over the wood nailers. Cut ends parallel

to and over center lines of wood nailers. Nail subflooring securely to each wood nailer with 7 penny steel spiral screw nails; use two nails for 4 and 6 inch wide boards. Space boards approximately 1/8 inch apart. Top of subflooring shall have a true, even plane. Provide 2 inches of clearance between subflooring and perimeter walls and other permanent obstructions.

#### 3.2.4.5 Felt

Cover wood subflooring with a layer of the felt. Butt edges tightly. Do not extend felt over air space between ends and sides of finished floor and perimeter walls or other permanent obstructions.

#### 3.2.4.6 Laying of Finished Flooring

Begin installation of flooring in center of space with double-tongue strips of flooring. Lay flooring at right angles to the wood nailers and parallel with the long dimension of the room. Blind nail each strip of flooring through the subflooring and into the sleeper with 8 penny screw type nails, spaced not over 12 inches apart over the sleepers. Leave a continuous air space 2 inches wide between the finished flooring and perimeter walls and other permanent obstructions. Stagger end joints of adjacent strips of flooring so that there will be at least two boards between each joint.

#### 3.2.5 Flooring on Plywood Subflooring With Rubber Pads

##### 3.2.5.1 Installation of Plywood Subflooring With Rubber Pads

Provide two layers of 1/2 inch thick plywood sheets, of 4 by 8 feet. Each 4 by 8 foot sheet in the bottom layer bearing on slab must have 32 rubber pads, 2-1/4 by 3 by 3/8 inch thick, approximately 12 inches on center in each direction, stapled to underside of sheet. Partial sheets must have rubber pads 12 inches on center and at perimeters. Lay first layer of plywood on concrete floor slab, parallel to short side of room. Lay second layer at a 45 degree angle to first layer and fasten it to first layer by machine nailing or stapling on 24 inch centers using one inch nails or staples. Leave a continuous air space 2 inches wide between the subflooring and perimeter walls and other permanent obstructions and 1/4 inch between panels at sides and ends. Lap panels so that no joint will fall over any joint of the first layer. [ In areas where fixed or temporary seats are indicated, provide fixed hardboard shims, 1/8 inch thick, between the cushioned pads.]

##### 3.2.5.2 Laying of Finished Flooring

Begin installation of flooring in center of space with double-tongue strips of flooring. Lay flooring parallel with the long dimension of the room. Flooring must be blind nailed on 10 inch centers with 1-3/4 inch spiral screw nails. Leave a continuous air space, 2 inches wide, between the finished flooring and perimeter walls and other permanent obstructions. Stagger end joints of adjacent strips of flooring so that there will be at least two boards between each joint. [ Roller skating rink flooring shall be 33/32 inch thick or 25/32 inch and laid in special octagonal pattern as indicated. Diagonal intersections of flooring shall be joined with barbed steel splines.]

#### 3.2.6 Flooring, Continuous Steel-Splined, [on Cork Underlayment]

##### 3.2.6.1 Vaporproofing for Slabs on Grade

Prime concrete slab with asphalt primer using a minimum of **one gallon per 250 square feet**. Following application and drying of the primer apply a membrane of two layers of felt. Lay each layer of felt in a coating of trowelled asphalt mastic, applied at the rate of at least **one gallon per 35 square feet**. Felts shall be butted at joints. Turn up felt **1-1/2 inches** at perimeter walls and other permanent obstructions. Roll felt thoroughly, eliminating air pockets and blisters, to provide an overall smooth and level surface. Cover top layer of felt with a coating of trowelled asphalt mastic applied at the rate of at least **one gallon per 35 square feet**.

#### [3.2.6.2 Cork Underlayment

Install underlayment in asphalt mastic. Provide a **1/16 inch** space at joints of corkboard. After underlayment has been installed, roll entire area with a **150 pound** roller to attain maximum bond and a uniformly even surface. Leave a **1-1/2 inch** air space between underlayment and perimeter walls and other permanent obstructions.

#### ]3.2.6.3 Finished Flooring

Lay **12 inch** long strips of finished flooring firmly in full bed of asphalt mastic in end-to-end courses, interlocking with saw-tooth steel splines into the slotted ends. Break joints of continuous strip units in succeeding courses. Lay continuous strip units parallel with the width of the room. Lay flooring level and in correct alignment. Leave a continuous air space, **1-1/2 inches** wide, between the finished flooring and perimeter walls and other permanent obstructions. Lay flooring with hairline joints. Do not drive flooring up tightly.

#### 3.2.7 Hardwood Base Installation

Install molded and perforated continuous hardwood base of the type indicated, along perimeter walls. Base shall have **3/8 inch** diameter vent holes spaced **5 inches** on center in a straight row. Nail or bolt base to wall. Do not fasten base to flooring.

#### 3.2.8 Molded-Rubber Base Installation

Install molded-rubber base firmly on perimeter walls in continuous adhesive as recommended by the base manufacturer. Provide vertical, circular or semicircular vent holes in base spaced **5 inches** on center in a straight row. Do not fasten base to flooring.

#### 3.2.9 Steel Angle Base Installation

Install **3 by 3 by 3/16 inch** continuous steel angle along perimeter walls. Bottom leg of angle shall have **3/8 inch** diameter vent holes spaced **5 inches** on center in a straight row. Fasten angle to wall at intervals of **16 inches** with countersunk head [expansion] [toggle] bolts. Do not fasten angle to flooring.

#### 3.3 SANDING, FINISHING, AND MARKING

##### 3.3.1 Sanding

Sand wood floor surfaces with a machine using coarse, medium, and fine grades of sandpaper; the edges must be sanded to a smooth edge; the finished surface must be smooth and level, free from scratches. A final disc sanding shall be provided. After final sanding or buffing, vacuum

floors until clean. Do not walk on floors thereafter until finish has been applied and is dry.

### 3.3.2 Finishing

[Finishing must be provided as specified in [\_\_\_\_].] [Within one day after the final sanding, buffing, and sweeping have been completed, use a tacky rag to clean flooring with a low VOC solvent recommended by the manufacturer of the floor finish material. Follow cleaning with a coating of sealer; when thoroughly dry, burnish with No. 2 steel wool, using a power machine. After final burnishing and prior to application of final finish coat(s), layout and mark game lines as specified herein; after game lines are thoroughly dry, apply final finish coat.] Floors must be wiped with a tacky rag each burnishing. [ Finish floors in accordance with MFMA SSCLFMGF. Four Coat Specification: Group II finish must consist of one sealer coat and three finish coats. Group III finish must consist of two sealer coats and two finish coats. Allow 5 days for proper curing.]

### 3.3.3 Marking

Lay out game lines and fields [and patterns] where indicated, masking edges to provide sharp, clean edges. Edge must be straight and width shall be uniform. Apply marking of colors indicated, providing a minimum dry film thickness of one mil.

## 3.4 PROTECTION

After completion of laying, finishing, and marking of the flooring, do not use the floor for at least 72 hours. Avoid heavy traffic on the floor for at least one week. Upon floor drying, use nonstaining, porous building paper of the type and grade recommended by manufacturer, taped along edges. Remove kraft paper covering after work in this area is completed.

-- End of Section --

## SECTION 09 65 00

RESILIENT FLOORING  
08/10, CHG 3: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

ATFS STANDARDS (2015) American Tree Farm System Standards of Sustainability 2015-2020

## ASTM INTERNATIONAL (ASTM)

ASTM D4078 (2002; R 2015) Water Emulsion Floor Polish

ASTM D5603 (2001; R 2008) Rubber Compounding Materials - Recycled Vulcanizate Particulate Rubber

ASTM E648 (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F710 (2021) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

ASTM F1066 (2004; R 2014; E 2014) Standard Specification for Vinyl Composition Floor Tile

ASTM F1303 (2004; R 2021) Standard Specification for Sheet Vinyl Floor Covering with Backing

ASTM F1344 (2021a) Standard Specification for Rubber Floor Tile

ASTM F1482 (2021) Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring

ASTM F1700 (2020) Standard Specification for Solid Vinyl Floor Tile

ASTM F1859 (2021a) Standard Specification for Rubber Sheet Floor Covering Without Backing

ASTM F1860 (2021) Standard Specification for Rubber Sheet Floor Covering With Backing

ASTM F1861 (2021) Standard Specification for

## Resilient Wall Base

ASTM F1869	(2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F1913	(2004; R 2014) Vinyl Sheet Floor Covering Without Backing
ASTM F2034	(2008; R 2013) Sheet Linoleum Floor Covering
ASTM F2169	(2015; R 2020; E 2020) Standard Specification for Resilient Stair Treads
ASTM F2170	(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
ASTM F2195	(2013) Linoleum Floor Tile

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## CSA GROUP (CSA)

CSA Z809-08	(R2013) Sustainable Forest Management
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## FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship
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## GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use
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## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 3813	(2004) Resilient Floor Coverings - Cork Floor Tiles
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## PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013	(2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements
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## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
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## SUSTAINABLE FOREST INITIATIVE (SFI)

SFI 2015-2019

(2015) Standards, Rules for Label Use,  
Procedures and Guidance

## UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Resilient Flooring and Accessories; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Resilient Flooring and Accessories; G[, [\_\_\_\_\_]]

Adhesives

Vinyl Composition Tile

[ Recycled content for Vinyl Composition Tile; S]

Sheet Vinyl Flooring

[ Recycled content for Sheet Vinyl Flooring; S]

Luxury Vinyl Tile

[ Recycled content for Luxury Vinyl Tile; S]

Rubber Tile

Rubber Sheet Flooring

Solid Vinyl Tile

Cement-Fiber Board

Wall Base

Stair Treads, Risers and Stringers

[ Sheet Linoleum]

[ Recycled content for Sheet Linoleum; S]

- [ Bio-based content for Sheet Linoleum; S]  
Linoleum Tile
- [ Recycled content for Linoleum Tile; S]
- [ Bio-based content for Linoleum Tile; S]  
Cork Flooring
- [ Recycled content for Cork Flooring; S]
- [ Bio-based content for Cork Flooring; S]

## SD-04 Samples

Resilient Flooring and Accessories; G[, [\_\_\_\_\_]]

## SD-06 Test Reports

Moisture, Alkalinity and Bond Tests; G[, [\_\_\_\_\_]]

## SD-07 Certificates

- [ Indoor Air Quality for Vinyl Composition Tile; S]
- [ Indoor Air Quality for Sheet Vinyl Flooring; S]
- [ Indoor Air Quality for Rubber Tile; S]
- [ Indoor Air Quality for Rubber Sheet Flooring; S]
- [ Indoor Air Quality for Luxury Vinyl Tile; S]
- [ Indoor Air Quality for Solid Vinyl Tile; S]
- [ Indoor Air Quality for Sheet Linoleum; S]
- [ Indoor Air Quality for Linoleum Tile; S]
- [ Indoor Air Quality for Cork Flooring; S]
- [ Indoor Air Quality for Wall Base; S]
- [ Indoor Air Quality for Adhesives; S]
- [ Certified Sustainably Harvested Cork Flooring; S]

## SD-08 Manufacturer's Instructions

Surface Preparation; G[, [\_\_\_\_\_]]

Installation; G[, [\_\_\_\_\_]]

## SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories; G[, [\_\_\_\_\_]]



### 1.3 CERTIFICATES

#### 1.3.1 Indoor Air Quality

Submit required indoor air quality certifications and validations in one submittal package.

##### 1.3.1.1 Floor Covering Materials

Provide [Vinyl Composition Tile] [Sheet Vinyl Flooring] [Rubber Tile] [Rubber Sheet Flooring] [Luxury Vinyl Tile] [Solid Vinyl Tile] [Sheet Linoleum] [Linoleum Tile] [Cork Flooring], and wall base products certified to meet indoor air quality requirements by FLOORSCORE, [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification by other third-party programs. Provide current product certification documentation from certification body.

##### 1.3.1.2 Adhesives, Caulking and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS Global Services Indoor Advantage Gold](#) or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

##### [1.3.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by [FSC STD 01 001](#) [, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019 Standards and Rules](#), or other third party program certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

### ]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area [free from strong contaminant sources and residues](#) with ambient air temperature maintained above [68 degrees F](#) and below [85 degrees F](#), stacked according to manufacturer's recommendations. [Remove resilient flooring products from packaging to allow ventilation prior to installation.](#) Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. [Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound \(VOC\) emissions, including \[\\_\\_\\_\\_\\_\]. Do not store exposed rubber surface materials in occupied spaces.](#) [Do not store [\_\_\_\_\_] near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.]

### 1.5 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 68 degrees F and below 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 55 degrees F thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

#### 1.6 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

#### 1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

#### 1.8 EXTRA MATERIALS

Provide extra flooring material of each color and pattern at the rate of [[\_\_\_\_\_] [5] tiles for each 1000 tiles] [and] [[\_\_\_\_\_] [5] square feet for each 1000 square feet of sheet flooring] installed. Provide extra wall base material composed of 20 linear feet of each type, color and pattern. Package all extra materials in original properly marked containers bearing the manufacturer's name, brand name, pattern color name and number, production run, and handling instructions. Provide extra materials from the same lot as those installed. Leave extra stock at the site in location assigned by Contracting Officer.

### PART 2 PRODUCTS

#### 2.1 VINYL COMPOSITION TILE [TYPE [A] [\_\_\_\_\_] ]

Conform to ASTM F1066 [Class 1, (solid color tile),] [Class 2, (through pattern tile),] Composition 1, asbestos-free, [12] [\_\_\_\_\_] inch square and [3/32] [1/8] inch thick. Provide color and pattern uniformly distributed throughout the thickness of the tile.

[ Provide Vinyl Composition Tile containing a minimum of 10 percent recycled content. Provide data identifying percentage of recycled content for Vinyl Composition Tile.]

[ Provide certification of indoor air quality for Vinyl Composition Tile.]

#### 2.2 SHEET VINYL FLOORING [TYPE [A] [\_\_\_\_\_] ]

Conform to [ASTM F1303, Type I, Grade 1, [Class A-non-asbestos formulated fibrous backing] [or] [Class B-nonfoamed plastic backing] (minimum wear layer thickness 0.020 inch and minimum overall thickness 0.080 inch) and a minimum [ 6 feet] [ 12 feet] wide.] [ ASTM F1303, Type II, Grade 1, without backing (minimum wear layer thickness 0.080 inch and minimum overall thickness 0.080 inch), and a minimum 6 feet wide. Extend color and pattern through the total thickness of the material.] [ ASTM F1303, Type II, Grade 1, [Class A non-asbestos formulated fibrous backing] [or] [Class B nonfoamed plastic backing] (minimum wear layer thickness 0.050 inch and minimum overall thickness 0.080 inch) and a minimum 6 feet wide. Extend color and pattern throughout the thickness of the wear layer.] [ ASTM F1913, (minimum wear layer thickness 0.075 inch and minimum overall thickness

0.075 inch) and a minimum 6 feet wide. Extend color and pattern through the total thickness of the material.] As required, provide welding rods as recommended by the manufacturer for heat welding of joints.

[ Provide Sheet Vinyl Flooring containing a minimum of 25 percent recycled content. Provide data identifying percentage of recycled content for Sheet Vinyl Flooring.]

[ Provide certification of indoor air quality for Sheet Vinyl Flooring.]

### 2.3 RUBBER TILE [TYPE [A] [\_\_\_\_\_]]

Conform to ASTM F1344 [Class 1 homogeneous] [Class 2 layered], [Type A (solid color)] [Type B (through mottled)], [12] [18] [24] [36] [\_\_\_\_\_] inch square. Provide [smooth] [\_\_\_\_\_] [raised [round] [square] [diamond] surface studs with chamfered edges. Provide [high] [low]] stud profile. Provide [0.125] [\_\_\_\_\_] inch overall thickness. [With Vulcanizate Particulate Rubber, use recycled tire treads in accordance with ASTM D5603, fine mesh size particulate, [Grade 1, 2, or 3] [Grade 4] [Grade 5] [Grade 6]].

[ Provide certification of indoor air quality for Rubber Tile.]

### 2.4 RUBBER SHEET FLOORING [TYPE [A] [\_\_\_\_\_]]

Conform to [ASTM F1859 (flooring without backing), [Type I homogeneous] [Type II layered]] [or] [ASTM F1860 (flooring with backing), [Type I homogeneous] [Type II layered]], [minimum] [ 36 inch] [\_\_\_\_\_] wide. Provide [smooth] [embossed] [\_\_\_\_\_] surface. Provide [0.080] [0.100] [0.118] [\_\_\_\_\_] inch overall thickness.[ With Vulcanizate Particulate Rubber, use recycled tire treads in accordance with ASTM D5603, fine mesh size particulate, [Grade 1, 2, or 3] [Grade 4] [Grade 5] [Grade 6].]

[ Provide certification of indoor air quality for Rubber Sheet Flooring.]

### 2.5 LUXURY VINYL TILE [TYPE [A] [\_\_\_\_\_]]

Conform to ASTM F1700 Class III printed film with a minimum wear layer thickness [ 0.020 inch (20 mil)][ 0.030 inch (30 mil)][\_\_\_\_\_] and minimum overall thickness [[ 0.098 inch] [or] [ 0.118 inch]] [ 0.197 inch[ with non slip/skid backing]], Type [A (smooth)] [B (embossed)]. Provide[ [12 by 24] [\_\_\_\_\_] inch][ [12] [16] [18] [24] [36] [\_\_\_\_\_] inch square][\_\_\_\_\_] tile.[ Provide tile with a factory protective finish that enhances cleanability and durability.]

[ Provide Luxury Vinyl Tile containing a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for Luxury Vinyl Tile.]

[ Provide certification of indoor air quality for Luxury Vinyl Tile.]

### 2.6 SOLID VINYL TILE [TYPE [A] [\_\_\_\_\_]]

Conform to ASTM F1700 Class I monolithic (minimum wear layer thickness 0.125 inch and minimum overall thickness 0.125 inch, Type [A (smooth)] [B (embossed)]. Provide [12] [16] [18] [24] [36] [\_\_\_\_\_] inch square tile.

[ Provide certification of indoor air quality for Solid Vinyl Tile.]

## 2.7 SHEET LINOLEUM [TYPE [A] [\_\_\_\_\_]]

Conform to **ASTM F2034** and consist of a homogeneous layer of a mixture of linoleum cement (binder in linoleum consisting of a mixture of linseed oil, pine rosin, fossil, or other resins or rosins, or an equivalent oxidized oleoresinous binder), cork and/or wood flour, mineral fillers, and pigments bonded to a jute backing. Provide a minimum 6 feet wide and overall thickness not less than [ 0.080 inch] [ 0.100 inch] [ 0.125 inch] for linoleum. As required, provide welding rods as recommended by the manufacturer for heat welding of joints.

Provide Sheet Linoleum containing a minimum of 30 percent recycled content. Provide data identifying percentage of **recycled content for Sheet Linoleum**.

Provide Sheet Linoleum products with minimum 95 percent bio-based content. Submit data identifying percentage of **bio-based content for Sheet Linoleum**.

[ Provide certification of **indoor air quality for Sheet Linoleum**.]

## 2.8 LINOLEUM TILE [TYPE [A] [\_\_\_\_\_]]

Conform to **ASTM F2195** and consist of a homogeneous layer of a mixture of linoleum cement (binder in linoleum consisting of a mixture of linseed oil, pine rosin, fossil, or other resins or rosins, or an equivalent oxidized oleoresinous binder), cork or wood flour, mineral fillers, and pigments bonded to a [polyester] [\_\_\_\_\_] backing. Provide square tiles a minimum [ 18 inch] [\_\_\_\_\_] square and overall thickness [ 0.08 inch] [\_\_\_\_\_] minimum for linoleum tile.

Provide Linoleum Tile containing a minimum of 30 percent recycled content. Provide data identifying percentage of **recycled content for Linoleum Tile**.

Provide Linoleum Tile with minimum 90 percent bio-based content. Submit data identifying percentage of **bio-based content for Linoleum Tile**.

[ Provide certification of **indoor air quality for Linoleum Tile**.]

## 2.9 CORK FLOORING

Conform to **ISO 3813**, and be [12] [\_\_\_\_\_] inches square and [3/16] [\_\_\_\_\_] inches to [5/16] [\_\_\_\_\_] inches thick. [Provide cork-faced MDF tongue-and-groove planks with cork facing.] Do not use products made with urea-formaldehyde binder.

[ Provide Cork Flooring containing a minimum of 95 percent recycled content. Provide data identifying percentage of **recycled content for Cork Flooring**.]

Provide Cork Flooring with minimum 100 percent bio-based content. Submit data identifying percentage of **bio-based content for Cork Flooring**.

[ Provide certification of **indoor air quality for Cork Flooring**.]

[ Provide **certified sustainably harvested Cork Flooring**.]

## 2.10 WALL BASE

Conform to **ASTM F1861**, [[Type TS (vulcanized thermoset rubber)] [or] [Type TP (thermoplastic rubber)]] [, or] [Type TV (thermoplastic vinyl)], [Style

A (straight - installed with carpet)] [, ] [and] [Style B (coved - installed with resilient flooring)] [, ] [and] [Style C (butt toe cove installed with 1/8 inch thick flooring)]. Provide [4] [6] inch high and a minimum 1/8 inch thick wall base. Provide [preformed] [job formed] corners in matching height, shape, and color. [ With Vulcanizate Particulate Rubber, use recycled tire treads in accordance with ASTM D5603, fine mesh size particulate, [Grade 1, 2, or 3] [Grade 4] [Grade 5] [Grade 6].]

[ Provide certification of indoor air quality for Wall Base.]

#### 2.11 INTEGRAL COVE BASE

Extend integral coved base for [[sheet vinyl] [and] [sheet linoleum] flooring up the wall [4] [6] inch]. Provide a [vinyl] [or] [rubber] [clear anodized aluminum], [square] [round] cap strip and vinyl, rubber, or wood fillet strip with a minimum radius of 3/4 inch for integral coved bases [at perimeter and fixed vertical interruptions to flooring] [as shown]. Provide integral cove of the same material as flooring. [Provide inside and outside corner protectors of [[\_\_\_\_\_] -colored anodized aluminum] [clear anodized aluminum] [or] [plastic] approved by flooring manufacturer.]

#### 2.12 STAIR TREADS, RISERS AND STRINGERS

Conform to ASTM F2169, [[Type TS (vulcanized thermoset rubber)] [or] [Type TP (thermoplastic rubber)]] [or] [Type TV (thermoplastic vinyl)]. Conform to ASTM F2169 for surface of treads [Class 1 smooth] [[Class 2 raised [round] [square] [diamond] stud] [ribbed] pattern] [and have [Group 1 abrasive non-slip strip] [Group 2 strip for visually impaired of contrasting [\_\_\_\_\_] color of [same] [abrasive] material]]. Provide [square] [or] [round] nosing. Provide either a one piece nosing/tread/riser or a two piece nosing/tread design with a matching coved riser. [ With Vulcanizate Particulate Rubber, use recycled tire treads in accordance with ASTM D5603, fine mesh size particulate, [Grade 1, 2, or 3] [Grade 4] [Grade 5] [Grade 6].]

#### 2.13 MOULDING

Provide tapered mouldings of [[vinyl] [or] [rubber]] [[\_\_\_\_\_] -colored anodized aluminum] [clear anodized aluminum] and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 1/4 inch. Provide bevel change in level between 1/4 and 1/2 inch with a slope no greater than 1:2.

#### 2.14 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) or VOC content requirements of GS-36. Provide certification or

validation of indoor air quality for adhesives.

#### 2.15 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Comply with ASTM F1482 for panel type underlayment products. Use one of the following substrates:

[ a. Particleboard: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[ b. Fiberboard: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[ c. Cork: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[ d. Cement-fiber board: As specified in Section 09 29 00 GYPSUM BOARD.]

[ e. Plywood: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[ f. Concrete.]

#### 2.16 POLISH/FINISH

Provide polish finish as recommended by the manufacturer and conform to ASTM D4078 for polish.

#### 2.17 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

#### 2.18 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated on the drawings] [selected from manufacturer's standard colors] [[\_\_\_\_\_]. Color listed is not intended to limit the selection of equal colors from other manufacturers]. [ Provide floor patterns as specified on the [drawings Sheet No. [\_\_\_\_\_]] [\_\_\_\_\_].] Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. Submit manufacturer's descriptive data and [three] [\_\_\_\_\_] samples of each indicated color and type of flooring, base, mouldings, and accessories sized a minimum 2-1/2 by 4 inch. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

#### 2.19 FIRE RESISTANCE TESTING REQUIREMENTS

Provide a minimum average critical radiant flux of [0.22] [0.45] watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E648.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation.

Do not take any corrective action without written permission from the Government. Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

### 3.2 SURFACE PREPARATION

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within **3/16 inch in 10 feet**. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Comply with **ASTM F710** for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayments, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Comply with **ASTM F1482** for panel type underlayments. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

### 3.3 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with **ASTM F1869** or **ASTM F2170**, unless otherwise recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

### 3.4 GENERAL INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

### 3.5 PLACING VINYL COMPOSITION, LINOLEUM AND SOLID VINYL TILES

Install tile flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

### 3.6 PLACING LUXURY VINYL TILES

[Install luxury vinyl tile flooring using [glue down] [loose lay (room perimeter adhesive only)] installation. ]Install flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions for installation method specified. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

### 3.7 PLACING SHEET VINYL FLOORING

Install sheet vinyl flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Lay out sheets to minimize waste. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied. [ Provide [chemically bonded] [or] [heat welded] seams and edges [in rooms [\_\_\_\_]] [shown on the drawings] in accordance with the manufacturer's written installation instructions. Finish joints flush, free from voids, recesses, and raised areas.] [Install flooring with an integral coved base.]

### 3.8 PLACING SHEET LINOLEUM FLOORING

Install sheet linoleum flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Lay out sheets to minimize waste. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied. Cut seams by overlapping or underscribing as recommended by the manufacturer. [Provide heat welded seams [in rooms [\_\_\_\_]] [as shown on the drawings] in accordance with there manufacturer's written installation instructions.] Finish joints flush, free from voids, recesses, and raised areas. [Install flooring with an integral coved base.]

### 3.9 PLACING RUBBER TILE

Install rubber tile and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Vary width of edge tiles as necessary to maintain full-size tiles, except where irregular-shaped rooms makes it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied.



### 3.10 PLACING RUBBER SHEET FLOORING

Install rubber sheet flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Cut seams by overlapping or underscribing as recommended by the manufacturer. Lay out sheets to minimize waste. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied.

### 3.11 PLACING CORK FLOORING

Install cork [tile] [plank flooring] and accessories in accordance with manufacturer's installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Provide square, symmetrical, tight, and even flooring lines and joints except where slope is indicated. Keep each floor in true, level plane, except where slope is indicated. [Vary width of edge tiles as necessary to maintain full-size tiles in field, while keeping edge tiles larger than one-half full size, except where irregular-shaped rooms make it impossible.] Cut and fit flooring around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit and scribe flooring to walls and partitions after field flooring has been applied.

### 3.12 PLACING FEATURE STRIPS

Install feature strips in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions.

### 3.13 PLACING MOULDING

Provide moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. [Secure moulding with adhesive as recommended by the manufacturer. Prepare and apply adhesives in accordance with manufacturer's printed directions.] [Anchor aluminum moulding to floor surfaces as recommended by the manufacturer.]

### 3.14 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

### 3.15 PLACING STAIR TREADS, RISERS, AND STRINGERS

Secure and install stair treads, risers, and stringers in accordance with manufacturer's printed installation instructions. Cover the surface of treads and risers [ the full width of the stairs] [ within 6 inch to the stair edges]. Provide equal length pieces butted together to cover the

treads and risers for stairs wider than manufacturer's standard lengths. [Provide stringer angles on both the wall and banister sides of the stairs, and landing trim.]

### 3.16 PLACING INTEGRAL COVED BASE

Install integral cove base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Shape integral coved base by extending the flooring material [4] [6] [\_\_\_\_\_] inch onto the wall surface. Support cove by a filler. Provide a cap strip at the top of the base. Fill voids along the top edge of base at masonry walls with caulk.

### 3.17 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry and clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and finish in accordance with manufacturer's written instructions.

### 3.18 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

## SECTION 09 65 66

## RESILIENT ATHLETIC FLOORING

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D624	(2000; R 2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D1054	(2002; R 2007) Rubber Property - Resilience Using a Rebound Pendulum
ASTM D1894	(2014) Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D2632	(2015; R 2019) Standard Test Method for Rubber Property-Resilience by Vertical Rebound
ASTM E648	(2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM F1303	(2004; R 2021) Standard Specification for Sheet Vinyl Floor Covering with Backing
ASTM F1869	(2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F2170	(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
ASTM F2772	(2011) Standard Specification for Athletic

Performance Properties of Indoor Sports  
Floor Systems

**ASTM G21** (2015; R 2021; E 2021) Standard Practice  
for Determining Resistance of Synthetic  
Polymeric Materials to Fungi

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

**CDPH SECTION 01350** (2010; Version 1.1) Standard Method for  
the Testing and Evaluation of Volatile  
Organic Chemical Emissions from Indoor  
Sources using Environmental Chambers

## CARPET AND RUG INSTITUTE (CRI)

**CRI GL CUSHION** Green Label Cushion Program

**CRI GLP QM** (2017) Green Label Plus Quality Manual

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

**ISO 9001** (2015) Quality Management Systems-  
Requirements

**ISO 14001** (2015) Environmental Management Systems –  
Requirements with Guidance for Use

## RESILIENT FLOOR COVERING INSTITUTE (RFCI)

**FLOORSCORE** FLOORSCORE IAQ Certification

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

**SCS** SCS Global Services (SCS) Indoor Advantage

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

**SCAQMD Rule 1113** (2016) Architectural Coatings

**SCAQMD Rule 1168** (2017) Adhesive and Sealant Applications

## UNDERWRITERS LABORATORIES (UL)

**UL 2818** (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-02 Shop Drawings**

Approved Detail Drawings; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

##### Installation

Indoor Air Quality for Rubber Poured-In-Place Flooring; S

Indoor Air Quality for Urethane Poured-In-Place Flooring; S

Indoor Air Quality for Adhesives; S

Indoor Air Quality for Primer; S

Indoor Air Quality for Game Line Marking Materials; S

#### SD-04 Samples

##### Flooring

#### SD-06 Test Reports

##### Laboratory Test Results

#### SD-07 Certificates

Indoor Air Quality for Indoor-Outdoor Carpeting; S

Indoor Air Quality for Rubber Composition Tile; S

Indoor Air Quality for Sheet Rubber Composition Flooring; S

Indoor Air Quality for Sheet Vinyl Composition Flooring; S

Indoor Air Quality for Resilient Mat Underlay; S

Indoor Air Quality for Wall Base; S

#### SD-11 Closeout Submittals

##### Warranty

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Shop Drawings

Provide approved detail drawings showing, as a minimum, installation details and locations of borders, patterns, and locations of floor seams.

#### 1.3.2 Manufacturer Qualifications

Manufacturer must have at least ten years active experience in the manufacturing and marketing of indoor resilient athletic flooring, and be a certified manufacturer in accordance with [ISO 9001](#) and [ISO 14001](#). Manufacturer must also have an authorized installer training program.

#### 1.3.3 Installer Qualifications

Installer must have at least five years of experience in the installation

of resilient athletic flooring, and have experience on at least five projects of similar size, type and complexity as this Project. Installer must also utilize workers for this Project who are competent in techniques required by manufacturer of resilient athletic flooring installation indicated.

#### 1.3.4 Laboratory Test Results

##### 1.3.4.1 Performance Properties

Provide certification documents indicating testing per **ASTM F2772** has been performed and the product being supplied complies with the ASTM category/classification specified for this project. Information from product catalogs or sales literature is not sufficient.

##### 1.3.4.2 Shock Absorption

Shock absorption (force reduction) test results certified by an independent testing laboratory certified to perform such testing.

- a. ASTM test must be from certified North American laboratories.
- b. EN and DIN test must be from certified European laboratories.

##### 1.3.4.3 Fire Performance

Provide fire performance test results.

##### 1.3.5 Fire Test Characteristics

As determined by testing identical products according to **ASTM E648**, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.

##### 1.3.6 Athletic Performance Properties

Comply with **ASTM F2772** Performance Level C2 for force reduction and ball rebound.

##### 1.3.7 Adhesive Application

Adhesive applied and poured-in-place flooring must be installed by an experienced floor applicator approved by the manufacturer.

##### 1.3.8 Flooring Material Samples

Submit three samples minimum **9 x 11 inches** of each color of flooring material required and manufacturer's certificates stating that the resilient athletic flooring materials conform to the specified requirements. Labels or markings affixed to manufacturer's products attesting that products meet requirements specified herein will be accepted in lieu of certificates.

#### 1.4 CERTIFICATIONS

##### 1.4.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

#### 1.4.1.1 Floor Covering Materials

Provide rubber composition tile, sheet rubber composition flooring, sheet vinyl composition flooring, and wall base products certified to meet indoor air quality requirements by FLOORSCORE, UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide resilient mat underlay products certified to meet indoor air quality requirements by FLOORSCORE, UL 2818 (GreenGuard) Gold, SCS Global Services Indoor Advantage Gold, CRI GL CUSHION or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide indoor-outdoor carpeting products certified to meet indoor air quality requirements by UL 2818 (GreenGuard) Gold, SCS Global Services Indoor Advantage Gold, CRI GLP QM or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver Materials in manufacturer's original unopened containers with labels intact. Do not deliver materials to the installation area or installed before all work that may damage the materials or the finished floor, such as overhead work, is completed. Store materials in a clean, dry area. Maintain materials in storage at temperatures recommended by the manufacturer. Store protection boards flat and off the ground.

- a. Store flooring and installation materials in protected dry spaces, with ambient temperatures maintained within range recommended by manufacturer, but less than 55 degrees F nor more than 85 degrees F.
- b. Store the indoor resilient athletic surfacing rolls in an upright position on a smooth flat surface immediately upon delivery to Project.

#### 1.6 WARRANTY

##### 1.6.1 Manufacturer's Warranty

Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period. Material warranty must be direct from the product manufacturer. Material warranties from separate or third party insurance providers are not valid. Material warranties from private label distributors are not valid.

Failures include, but are not limited to, the following:

- a. Material manufacturing defects.
- b. Surface wear and deterioration to the point of wear-through.
- c. Failure due to substrate moisture exposure not exceeding 80 percent relative humidity when tested according to ASTM F2170 or 5 pounds moisture vapor emission rate when tested according to ASTM F1869.

##### 1.6.1.1 Warranty Period

For materials: Minimum of 2 years from date of Substantial Completion. For

surface wear: minimum of 15 years from date of Substantial Completion.

#### 1.6.2 Installer's Warranty

Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.

#### 1.7 COORDINATION

Coordinate layout and installation of flooring with other gymnasium equipment.

#### 1.8 EXTRA MATERIALS

##### 1.8.1 Floor Tiles

Furnish spare tiles of each color at the rate of [\_\_\_\_\_] [5] tiles for each 1000 tiles installed. Tiles must be from the same lot as those installed.

##### 1.8.2 Carpeting

Extra material from same dye lot consisting of full width continuous broadloom must be provided for maintenance. A minimum of [\_\_\_\_\_] percent of total square yards of each carpet type, pattern, and color must be provided.

### PART 2 PRODUCTS

#### 2.1 FLOORING MATERIALS

##### 2.1.1 Indoor-Outdoor Carpeting Type [A] [\_\_\_\_\_]

Carpet-type flooring that is spike proof [[ribbed] [berber] pattern consisting of a top layer of rugged [polypropylene] [or] [nylon] fibers combined with an inorganic cut-resistant [non-skid] [\_\_\_\_\_]] [wet areas artificial turf pattern consisting of a top layer of rugged polypropylene fibers combined with an inorganic cut-resistant [porous rubber knob] [foam] [\_\_\_\_\_]] backing. Minimum total thickness must be [0.375] [\_\_\_\_\_] inches. Finished surface pile yarn weight (face weight) must be minimum [\_\_\_\_\_] ounces/square yard. Test results for resistance to soil bacteria or fungi must show no sustained growth or discoloration after 21 days when tested in accordance with ASTM G21. Product must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for Indoor-Outdoor Carpeting.

##### 2.1.2 Rubber Composition Tile Type [A] [\_\_\_\_\_]

Provide [interlocked] [\_\_\_\_\_] [24 x 24] [\_\_\_\_\_] inches square, of solid first quality rubber, uniformly resilient material rubber tiles, designed to be applied [with] [without] adhesive. Provide tiles that are approximately [1/2] [\_\_\_\_\_] inch thick, [smooth] [traction] [\_\_\_\_\_] texture, and [reversible] [non-reversible]. Flooring must be able to withstand [75 percent compression for 22 hours at 158 degrees F] [\_\_\_\_\_] without residual deformation when tested in accordance with ASTM D395. Provide flooring with a durometer hardness Shore-A of 50-60 when tested in accordance with ASTM D2240. Product must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for Rubber Composition Tile.



### 2.1.3 Rubber Poured-In-Place Flooring Type [A] [\_\_\_\_\_]

Provide resilient poured-in-place rubber surface composed of chloroprene rubber, chloroprene rubber sponge, aggregate, setting powders, and a top finish composed of acrylic resins. Flooring must be able to withstand 50 percent compression for 72 hours at 72 degrees F with a residual deformation of less than 10 percent when tested in accordance with ASTM D395. Flooring must have a minimum compression modulus at 10 percent of 100 psi, a minimum elongation of 250 percent and a minimum tensile strength of 550 psi plus or minus 5 psi when tested in accordance with ASTM D412. Provide flooring with a durometer hardness Shore-A of 55-60 when tested in accordance with ASTM D2240 and a minimum tear resistance of 60 lbf/inch when tested in accordance with ASTM D624. For interior applications (defined as inside of the weatherproofing system) of rubber poured-in-place flooring, provide products meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1113. Provide validation of indoor air quality for Rubber Poured-In-Place Flooring.

### 2.1.4 Sheet Rubber Composition Flooring Type [A] [\_\_\_\_\_]

Provide prefabricated, homogeneous, natural and synthetic rubbers sheet rubber flooring, minimum [3/16] [\_\_\_\_\_] inch thick, and [smooth gymnasium] [textured all-purpose] finish. provide roll type flooring not less than 60 [\_\_\_\_\_] inches wide. Flooring must have a minimum tensile stress at 100 percent elongation of 220 psi and a minimum ultimate elongation of 250 percent when tested in accordance with ASTM D412. Flooring must be able to withstand 50 percent compression for 72 hours at 72 degrees F with a residual deformation of less than 10 percent when tested in accordance with ASTM D395. Flooring must provide a 55 plus or minus 5 percent rebound when tested in accordance with ASTM D1054. Product must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for Sheet Rubber Composition Flooring.

### 2.1.5 Sheet Vinyl Composition Flooring Type [A] [\_\_\_\_\_]

Provide sheet vinyl flooring consisting of a solid polyvinyl chloride material that conforms to the chemical resistance requirements of ASTM F1303. Provide flooring not less than 48 inches wide and a minimum thickness of [1/8] [\_\_\_\_\_] inch. Provide [smooth] [stipple] [track embossed] texture floor surface. Flooring must have a minimum coefficient of friction of 0.75 when tested in accordance with ASTM D1894. Provide flooring with an average thickness loss of 8.0 mils plus or minus 1 mil. Rebound resilience of flooring must be greater than 12 percent and less than 30 percent when tested in accordance with ASTM D2632. Product must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for Sheet Vinyl Composition Flooring. [Provide an optional compatible top coating recommended by the sheet vinyl flooring manufacturer.]

### 2.1.6 Urethane Poured-In-Place Flooring Type [A] [\_\_\_\_\_]

The resilient poured-in-place urethane surface is composed of a seamless pigmented monolithic material. Provide minimum [1/8] [\_\_\_\_\_] inch thick and [smooth gymnasium] [textured all-purpose] [textured track] finish flooring. Flooring must have a durometer hardness Shore-A of 55-60 when tested in accordance with ASTM D2240. Flooring must have a minimum

ultimate elongation of 250 percent when tested in accordance with [ASTM D412](#) and must have a density of 1.25.

For interior applications (defined as inside of the weatherproofing system) of urethane poured-in-place flooring, provide products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for Urethane Poured-in-Place Flooring](#).

## 2.2 RESILIENT MAT UNDERLAY

Provide prefabricated resilient mat underlay consisting of granulated indoor/outdoor rubber mat bound with polyurethane for shock absorption. Mat thickness must be [\_\_\_\_\_] inches. Product must meet emissions requirements of [CDPH SECTION 01350](#). Provide certification or validation of [indoor air quality for Resilient Mat Underlay](#).

## 2.3 ADHESIVES

Adhesive must be as recommended by the flooring manufacturer and correspond to the specified flooring product and to the substrate. Adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide validation of [indoor air quality for adhesives](#).

## 2.4 CRACK FILLER/LEVELER FOR CONCRETE SURFACES

Provide crack filler/leveler for concrete floor surfaces as recommended by flooring manufacturer.

## 2.5 EDGING STRIPS

Provide strips of the same material and design as recommended by flooring manufacturer.

## 2.6 PRIMER

Concrete primer must be as recommended by flooring manufacturer and correspond to the specified flooring product and to the substrate. For interior applications (defined as inside of the weatherproofing system) of primer, provide products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for primer](#).

## 2.7 GAME LINE MATERIAL

Game line material must be as recommended by the flooring manufacturer and correspond to the specified flooring product. For interior applications (defined as inside of the weatherproofing system) of game line marking materials, provide products meeting either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for game line marking materials](#).

## 2.8 WALL BASE

Base must be [rubber] [vinyl], Type [straight] [coved] style. Base must be 4 inches high and minimum 0.080 inch thick.[]

Product must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for wall base.]

## 2.9 SEALANTS

provide sealants in accordance with Section 07 92 00 JOINT SEALANTS.

## 2.10 MANUFACTURERS COLOR

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_].

# PART 3 EXECUTION

## 3.1 PREPARATION

Concrete surfaces must be completely cured and dry. Do not use curing agents, sealers, or hardeners to aid in the curing of the concrete slab. Surfaces must be free of paint spots, and other foreign materials. Surfaces must be ground down or leveled with an approved leveling compound to a tolerance of plus or minus 1/8 inch within a 10 foot radius. Cracks, construction joints, or damaged portions of floor must be filled with crack filler for concrete surfaces. Expansion joints must be filled and sealed in accordance with the approved installation instructions of the manufacturer. All sealants must be in accordance with ASTM C920. Expansion joints must not be filled with a material that will make them inoperable.

## 3.2 MOISTURE TEST

Confirm that the moisture content of concrete subfloors is in the range recommended by the flooring manufacturer before floor installation.

## 3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

### 3.3.1 General Requirements

Installation must be in accordance with the approved installation instructions. Tile or sheet flooring must be rolled with a medium-sized roller in both directions to release entrapped air. Submit manufacturer's descriptive data and catalog cuts indicating materials of construction and physical characteristics. Installation, cleaning and maintenance instructions must be included.

### 3.3.2 Molded Rubber Base

Install base in accordance with the approved installation instructions of the manufacturer of the base.

### 3.3.3 Indoor-Outdoor Carpeting

Apply flooring as recommended by the manufacturer.

### 3.3.4 Sheet Vinyl Composition Flooring

Prime the concrete slab in accordance with approved installation instructions. Install flooring as recommended by the manufacturer.

#### 3.3.4.1 Seams

Cut and place end seams as recommended by the manufacturer. Weight seams weighted as required.

#### 3.3.4.2 Hot-Welded Seams

Groove butted sheets to a depth of approximately two thirds of their total thickness using an electrical or hand grooving tool. Thermoweld grooved seams using a hot air welding tool and a PVC welding thread. After seam has cooled to room temperature, trim the excess off to provide a flush joint.

### 3.3.5 Sheet Rubber Composition Flooring

Sheet flooring must be dry cut and layed out flat a minimum of 24 hours prior to adhering to the substrate. Single cut end seams. Cut edge seams through overlapping sheets, then snap into place to ensure tight seams. Weight seams as required.

### 3.3.6 Rubber Composition Tile Flooring

#### 3.3.6.1 Application With Adhesive

Lay tiles on adhesive surface in pattern according to [approved detail drawings](#). Joints of tiles must be even and tight. Cut tiles to fit tightly against the wall. Submit drawings showing game lines, location of anchor plate assemblies, floor outlets, and under-floor conduit or raceways.

#### 3.3.6.2 Application Without Adhesive

Join tiles together using interlocking ears or other mechanical locking techniques. Interlock the ears into the adjoining tile [1-1/2 inches](#) and provide at least five interlocks for each [24 inch](#) edge. Where required, supply a beveled transfer border to interlock with the flooring tiles. The borders must be [6 inches](#) wide and [24 inches](#) long and the same thickness as the matching tiles.

### 3.3.7 Rubber Poured-in-Place Flooring

Prime the concrete slab with primer recommended by manufacturer in a thin film covering approximately [400 square feet per gallon](#). Pour chloroprene rubber onto subfloor and trowel to a smooth and uniform layer of the required thickness. Apply a grout chloroprene rubber coat to fill possible voids in surface. After the chloroprene rubber is completely dry, apply a pigmented finish with a spray and roller.

### 3.3.8 Urethane Poured-in-Place Flooring

Prime the concrete slab with primer recommended by the manufacturer. Rate of application must be in accordance with approved installation instructions and be allowed to dry odor free. Cover concrete construction

joints with 2 inch wide PVC duct tape. Apply resin in a minimum of 2 lifts. Apply pigmented and textured coatings in accordance with manufacturer's recommendations.

#### 3.3.9 Resilient Mat Underlay

Unroll the resilient mat underlay and allow to relax prior to cutting or fitting. Install the mat in accordance with manufacturers instructions.

#### 3.3.10 Line Marking and Finishing

After installation is complete, clean the floor surface in accordance with installation instructions. Lay out, mask, and paint line marking according to approved detail drawings and approved installation instructions. Finish in accordance with the manufacturer's recommendations.

### 3.4 PROTECTION

Protect the installed flooring from soiling and damage with heavy reinforced, nonstaining kraft paper, plywood, or hardboard sheets as required. Lap and secure edges of kraft paper protection to provide a continuous cover. Remove protective covering when directed by the Contracting Officer.

-- End of Section --

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## SECTION 09 66 13

## PORTLAND CEMENT TERRAZZO FLOORING

08/16, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C171	(2020) Standard Specification for Sheet Materials for Curing Concrete
ASTM C241/C241M	(2021) Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C309	(2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## NATIONAL TERRAZZO AND MOSAIC ASSOCIATION (NTMA)

NTMA Info Guide	(2017) Terrazzo Reference Guide
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## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113	(2016) Architectural Coatings
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[SD-02 Shop Drawings](#)

Installation; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Flooring System Materials

Recycled Content for Portland Cement Terrazzo Flooring System; S

Indoor Air Quality for Curing Material; S

Indoor Air Quality for Sealer; S

#### SD-04 Samples

Terrazzo Flooring

Divider Strips

Control Joint Strips

Colorants

#### SD-10 Operation and Maintenance Data

Cleaning and Sealing

#### SD-11 Closeout Submittals

Warranty

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's unopened containers marked with the brand name. Deliver, handle, and store materials in accordance with manufacturers instructions in a manner that prevents deterioration and contamination.

### 1.4 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive terrazzo at a temperature above 50 degrees F 24 hours prior to the time mixtures are placed and until completely cured.

### 1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period.

## PART 2 PRODUCTS

### [2.1 PORTLAND CEMENT TERRAZZO FLOORING SYSTEM MATERIALS

Provide system that has a minimum of [40 percent fly ash] [100 percent recycled aggregate] [\_\_\_\_\_]. Provide data identifying percentage of recycled content for portland cement terrazzo flooring system. Do not use coral, dolomite, or limestone aggregates in setting bed.

### ]2.2 PORTLAND CEMENT

Provide portland cement conforming to ASTM C150/C150M, Type I, of colors



required to match [NTMA Info Guide](#) color plate indicated [in Section 09 06 00 SCHEDULES FOR FINISHES].

### 2.3 SAND

Provide sand conforming to [ASTM C33/C33M](#) for fine aggregate.

### 2.4 MARBLE CHIPS

Provide marble chips of domestic origin of sizes and colors required to match [NTMA Info Guide](#) color plate indicated [in Section 09 06 00 SCHEDULES FOR FINISHES]. Marble chips must have an abrasive hardness of not less than 10 when tested in accordance with [ASTM C241/C241M](#); contain no deleterious or foreign matter; and less than one percent by weight dust content.

### 2.5 DIVIDER STRIPS

Provide divider strips in accordance with [NTMA Info Guide](#) and 1-1/4 inch deep, [\_\_\_\_\_] gauge thick and of [brass] [zinc] [plastic in color as indicated [in Section 09 06 00 SCHEDULES FOR FINISHES]]. Standard type one-piece divider strips must [be not lighter than No. 16 Brown & Sharpe gage thick] [be of thickness indicated]. Heavy-top strips may be either one- or two-piece strips with a solid top section, [not less than 1/4 inch nor more than 3/8 inch in depth and not less than [1/8] [1/4] inch thick] [of thickness shown]. Submit two 6 inch lengths of each type divider.

### 2.6 CONTROL JOINT STRIPS

Provide control joint strips in accordance with [NTMA Info Guide](#) and [\_\_\_\_\_] inches deep, [\_\_\_\_\_] gauge thick of [brass] [zinc]. Use neoprene filler [\_\_\_\_\_] inches thick in color as indicated [in Section 09 06 00 SCHEDULES FOR FINISHES]. Submit two 6 inch lengths of each type control joint strip.

### 2.7 COLORANTS

Provide alkali-resistant and nonfading colorants. Pigments must be of colors required to match [NTMA Info Guide](#) color plate indicated [in Section 09 06 00 SCHEDULES FOR FINISHES].

### 2.8 CURING MATERIAL

Curing material must be either liquid membrane-forming compound, wet sand, polyethylene sheeting, or water. Liquid membrane-forming compound must conform to [ASTM C309](#), Type I. Floor curing material products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for curing material](#). Polyethylene sheeting must conform to [ASTM C171](#).

### 2.9 TERRAZZO CLEANER

Use biodegradable, phosphate free terrazzo cleaner with a pH factor between 7 and 10 and of a type specially prepared for use on terrazzo. Submit maintenance instructions for bonded terrazzo.

### 2.10 SEALER

Sealer must [have a pH factor between 7 and 10 and] be a penetrating type specially prepared for use on terrazzo. The sealer must not discolor or amber the terrazzo and must produce a slip resistant surface. Flash point of sealer must be in accordance with [NTMA Info Guide](#). Sealer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for sealer](#).

## 2.11 SHEET MATERIALS

Sheet materials used for curing the terrazzo must conform to [ASTM C171](#).

## PART 3 EXECUTION

### 3.1 TERRAZZO PROPORTIONS

#### 3.1.1 Underbed

Use underbed composed of one part portland cement to [4] [4.5] parts sand. Add water to provide workability at as low a slump as possible. Spread to a level [1/2 inch](#) below the finished floor, to a thickness of approximately [1-1/4 inches](#).

#### 3.1.2 Terrazzo Topping

Topping must be composed of one [94 pound](#) bag of portland cement per [200 pounds](#) of marble chips and approximately [5 gallons](#) of water. Add color pigment as needed, but not to exceed [2 pounds](#) per bag of cement. Add water in sufficient quantity to provide workability at as low a slump as possible.

### 3.2 INSTALLATION

Submit drawings indicating the type, size, and layout of divider strips and control joint strips and color of floor areas.

#### 3.2.1 Underbed Placement

Clean and saturate concrete surfaces with water in accordance with [NTMA Info Guide](#). Do not treat concrete substrate to receive bonded terrazzo with curing agent or additives which would preclude bonding. Remove excess water from the subfloor before slushing and brooming with neat cement paste. Place the underbed on the concrete subfloor and screed to an elevation [1/2 inch](#) below the finished floor. Install divider strips in the semiplastic underbed. Firmly trowel the underbed along the edges to insure positive anchorage of the divider strips. Install control joint strips over subfloor expansion joints and extend the full depth of the underbed.

#### 3.2.2 Setting Divider Strips

Set in accordance with layout indicated while underbed is still plastic. Set strips to straight lines and to the proper level to ensure that tops of strips will show uniformly after completing grinding and finishing operations. Fit joints and intersections tight. Where divisions in field work are not shown, divide field work into squares or rectangles of uniform size and not more than [6 feet](#) on a side. Divide borders by strips to

coincide with the layout of division strips in the field of floors. Place edging strips at doorways between terrazzo and other types of flooring and along the edges of terrazzo borders adjoining other types of floor finishes or floor coverings. Place expansion strips over control joints, construction joints, and expansion joints.

### 3.2.3 Placing Terrazzo Topping

Slush and broom the underbed in accordance with [NTMA Info Guide](#) with neat cement paste of the same color as required for the topping. Place the topping in panels formed by divider strips and trowel level with the top of the strips. Seed the troweled surface with chips in the same color proportions as contained in the terrazzo mix, trowel and roll with heavy rollers until excess water has been extracted. Trowel the terrazzo to a uniform surface disclosing the lines of the divider strips.

### 3.2.4 Curing

Cure the terrazzo until the topping develops sufficient strength to prevent lifting or pulling of terrazzo chips during grinding. Keep the completed terrazzo continuously moist and free of traffic during the curing period. Cure by covering with a liquid membrane-forming compound, sheet materials, wet sand, or sprinkling with water.

### 3.2.5 Finishing

[Finish in accordance with [NTMA Info Guide](#).] [After curing the grout coat for a minimum of 72 hours, grind the floor using a No. 80 or finer grit stone. In the latter stages of grinding, use grit stones or other abrasive in the grinding machine of a grain or fineness that will give the surface a honed finish. Grind and rub by hand small areas, inaccessible portions, and corners that cannot be reached by the grinding machine. The honed surface of finished terrazzo must show not less than 70 percent of the area as exposed aggregate evenly distributed, and conform in appearance to the approved samples. Finished thickness of terrazzo topping must be a minimum of [1/2 inch](#).]

#### 3.2.5.1 Rough Grinding

After topping has cured, machine grind the terrazzo using the wet method, to a true even surface using No. 24 or finer grit followed by No. 80 grit or finer grit stone. Finish floor surface must not vary by more than [1/4 inch in 10 feet](#).

#### 3.2.5.2 Grouting

After rough grinding, cleanse and rinse the floor with clean water. After removing excess rinse water, grout the floor using identical portland cement, color and pigments as used in the topping taking care to fill voids. After the grout has attained its initial set, cure the surface for a minimum of 72 hours.

#### 3.2.5.3 Fine Grinding

After grout has cured, grind the surface with fine grit stones until all grout is removed from the surface. Upon completion of grinding, the [terrazzo flooring](#) must show a minimum of 70 percent of marble chips. Submit two [6 x 6 inch](#) (minimum) samples of each color of terrazzo

### 3.3 CLEANING AND SEALING

Wash the terrazzo with a neutral cleaner and, where required, clean with a fine abrasive to remove stains or cement smears. Rinse the cleaned surface. When dry, apply a terrazzo sealer in accordance with the manufacturer's directions.

### 3.4 PROTECTION

cover and protect the terrazzo work from damage until completion of the work of all other trades.

-- End of Section --

## SECTION 09 66 16

TERRAZZO FLOOR TILE  
08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C97/C97M	(2015) Absorption and Bulk Specific Gravity of Dimension Stone
ASTM C109/C109M	(2021) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
ASTM C501	(2021) Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
ASTM D2047	(2017) Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E648	(2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in

accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Terrazzo Tile; G[, [\_\_\_\_]]

SD-03 Product Data

Terrazzo Tile

Recycled Content for Terrazzo Tile; S

Adhesive

Indoor Air Quality for Adhesive; S

Installation

SD-04 Samples

Terrazzo Tile

Terrazzo Base

Metal Edge Strips

SD-10 Operation and Maintenance Data

Manufacturer's Maintenance Instructions; G[, [\_\_\_\_]]

SD-11 Closeout Submittals

Warranty

1.3 QUALITY ASSURANCE

Installer must possess, to the satisfaction of the Contracting Officer, the technical qualifications, experience, trained personnel, and facilities to properly install the specified items.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the jobsite in the manufacturer's original unopened containers marked with the manufacturer's brand name, color, and pattern. Store materials delivered and placed in storage protected from damage, weather, humidity and temperature variation, dirt and dust, or other contaminants. Temperature of storage area must not be lower than 50 degrees F or higher than 90 degrees F.

1.5 SITE CONDITIONS

Do not install tiles until other work that could cause damage to the finished flooring has been completed. Maintain a temperature of not less than 70 degrees F in all areas where tile is to be installed for a period of not less than [48] [\_\_\_\_] hours before, during and after laying of tiles. Bring tiles into installation areas and allow to condition at not less than 70 degrees F for a period of [48] [\_\_\_\_] hours prior to installation. After installation of tiles, maintain a minimum temperature of 55 degrees F.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of a manufacturer regularly engaged in the manufacture of the material and that essentially duplicate products that have been in satisfactory use at least 2 years prior to bid opening.

2.2 TERRAZZO TILE

Provide terrazzo tile of the indicated colors and consisting of [marble] [or] [granite] chips embedded in a [flexible] [or] [rigid] thermoset resin matrix. Submit drawings indicating pattern, size, style, and color of tiles and two 6 by 6 inch minimum samples of each color and pattern of terrazzo tile to be used. Tiles must be 3/16 [ ] inch thick and nominal [12 by 12] [ ] inches. Provide tiles with a [polished] [polished and [honed] [textured]] [honed] [textured] finish with uniform color distribution of chips. [Grade marble chips to 5/8] [1/4] inch maximum size.] [Granite chips must be manufacturer's standard gradation.] Provide tile with the following properties:

TERRAZZO TILE PROPERTIES		
PROPERTY	TEST METHOD	VALUE
Compressive Strength	ASTM C109/C109M	3000 psi minimum
Water Absorption	ASTM C97/C97M	0.7 percent maximum
Abrasive Wear	ASTM C501	Index 28
Coefficient of Friction	ASTM D2047	0.5 wet
Flame Spread	ASTM E84	Class A
Critical Radiant Flux	ASTM E648	Class I

[

Provide Terrazzo Tile with [50] [100] [ ] percent recycled aggregate. Provide data identifying percentage of recycled content for terrazzo tile.]

2.3 ADHESIVE

Adhesive must be flooring manufacturer's standard product or a product recommended by the manufacturer. Submit documentation from manufacturer indicating that the materials conform to the specified requirements and flooring manufacturer's approval of underlayment, adhesive, and cleaners. Adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom

spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide validation of indoor air quality for adhesive.

#### 2.4 TERRAZZO BASE

Provide terrazzo base of colors as indicated, meeting the requirements of paragraph TERRAZZO TILE and being a manufacturer's standard product. Base/strips must be [3/8] [3/4] inch thick by [\_\_\_\_\_] inch wide by [\_\_\_\_\_] inch long. Provide base/strips that have [polished] [honed] [textured] finish. Submit two 4 inch long samples of each type and color of trim pieces.

#### 2.5 TERRAZZO STRIPS

Provide terrazzo strips of colors as indicated, meeting the requirements of paragraph TERRAZZO TILE and being a manufacturer's standard product. Strips must be [3/8] [3/4] inch high by [\_\_\_\_\_] inch wide by [\_\_\_\_\_] inch long. Strips must have [polished] [honed] [textured] finish. Submit two 4 inch long samples of each type and color of trim pieces.

#### 2.6 METAL EDGE STRIPS

Metal edge strips must be extruded aluminum, butt type, approximately 1-1/2 inches wide with thickness to set top surface flush with top of tile and with bevel at exposed edge. Edge strips must have countersunk holes near each end and spaced not more than 8 inches on center for securement. Submit one 6 inch long sample of metal edge strip

#### 2.7 COLOR

Color must be [as indicated] [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_].

### PART 3 EXECUTION

#### 3.1 GENERAL

Install flooring and base on floor surfaces and walls where indicated. Except as required for installation of new tile, keep traffic new tile for at least [24] [\_\_\_\_\_] hours after installation.

#### 3.2 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

#### 3.3 SUBSTRATE PREPARATION

Fill holes and cracks with mortar. Floors must be free of curing compounds, grease, dirt, loose particles and other foreign matter that would prevent adhesion. Chip and grind smooth projecting irregularities. Fill depressions and level uneven surfaces. Rinse subfloors and allow to dry prior to applying adhesive.

#### 3.4 MOISTURE TEST

After concrete floor surfaces have been cleaned, spread small patches of adhesive in several locations in each room or area to receive tile and



allowed to dry overnight. If the adhesive can be peeled easily from the floor surfaces, the surface is not sufficiently dry. Repeat the steps until the adhesive adheres properly. Do not apply tiles until adhesive adheres tightly to the floor.

### 3.5 INSTALLATION

Submit the manufacturer's printed installation instructions for the conditions indicated.

#### 3.5.1 Tile

Install tile in accordance with the manufacturer's approved installation instructions, except as specified herein. Lay tile symmetrical about center lines of rooms or areas. Joints must be tight, inconspicuous as possible, and in alignment. Cut tile to fit snugly at pipes and other vertical surfaces. Seal joints at pipes with adhesive. Remove spots or smears of adhesive immediately. Entire surface of finished tile floor must be smooth, straight, and free from bleeding adhesive, buckles, waves, or projecting tile edges upon completion. Bleeding of adhesive on finished floors is cause for rejection by the Contracting Officer. Remove and replace damaged or rejected tiles.

#### 3.5.2 Metal Edge Strips

Secure edge strips with No. 10 aluminum alloy, counter-sunk, flathead machine screws with expansion sleeves. Provide exposed edges of tile with one-piece metal edge strips.

#### 3.5.3 Terrazzo Base/Strips

Terrazzo base/strips must be continuous and adhesively applied. Joints must be tight and inconspicuous in same manner as floor tile.

### 3.6 CLEANING

Upon completion of the installation and after adhesive has cured, thoroughly clean flooring in accordance with the manufacturer's recommendations.

### 3.7 PROTECTION

Cover and protect the terrazzo tile work from damage until completion of the work of all other trades. Remove and replace defects which develop, such as loose, broken, or curled tiles. Submit [six] [\_\_\_\_\_] copies of the [Manufacturer's Maintenance Instructions](#).

-- End of Section --

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## SECTION 09 67 23.13

## STANDARD RESINOUS FLOORING

11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A990/A990M	(2021) Standard Specification for Castings, Iron-Nickel-Chromium and Nickel Alloys, Specially Controlled for Pressure-Retaining Parts for Corrosive Service
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D445	(2019a) Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D1475	(2013) Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM D1544	(2004; R 2010) Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)
ASTM D1652	(2011; E 2012) Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness

ASTM D2471	(1999) Standard Test Method for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins
ASTM D4259	(2018) Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application
ASTM F1869	(2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F2170	(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
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## 1.2 ADMINISTRATIVE REQUIREMENTS

### 1.2.1 Pre-Installation Meetings

Pre-installation Conference: Conduct conference at Project site.

### 1.2.2 Product Data

Within [30] [\_\_\_\_\_] days of contract award, submit [manufacturer's catalog data](#) for the following items:

- a. Epoxy-Resin Binder/Matrix
- b. Cured Epoxy Binder
- [ c. Aggregate
- ] d. Surface Sealing Coat

### 1.2.3 Design Mix Data

Within [30] [\_\_\_\_\_] days of contract award, submit [design mix data](#) for the following items, including a complete list of ingredients and admixtures:

- a. Epoxy-Resin Binder/Matrix
- b. Cured Epoxy Binder
- c. Surface Sealing Coat

Ensure applicable test reports verify the mix has been successfully tested and meets design requirements.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will

review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings[; G[, [\_\_\_\_]]]

[ Fabrication Drawings[; G[, [\_\_\_\_]]]  
]

SD-03 Product Data

Manufacturer's Catalog Data[; G[, [\_\_\_\_]]]

SD-04 Samples

Hardboard Mounted Epoxy Flooring[; G[, [\_\_\_\_]]]

Floor Topping[; G[, [\_\_\_\_]]]

Mockups[; G[, [\_\_\_\_]]]

SD-05 Design Data

Design Mix Data[; G[, [\_\_\_\_]]]

SD-07 Certificates

Listing of Product Installations

Referenced Standards Certificates

SD-11 Closeout Submittals

Warranty[; G[, [\_\_\_\_]]]

1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction. Deliver materials in original packages, containers, or bundles bearing brand name and name of material.

Maintain materials used in the installation of floor topping at a temperature between 65 and 85 degrees F.

1.5 QUALITY CONTROL

Prior to commencement of work, submit **referenced standards certificates** for the following, showing conformance with the referenced standards contained in this section:

- a. Epoxy-Resin Binder/Matrix
- b. Cured Epoxy Binder
- c. Aggregate
- d. Surface Sealing Coat

1.5.1 **Mockups**

Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Apply full-thickness mockups on 96 inch square floor area selected by Contracting Officer. Simulate finished lighting conditions for the review of mockups.

#### 1.5.2 Qualifications

Submit a [listing of product installations](#) for heavy duty epoxy flooring including identification of at least [5] [\_\_\_\_\_] units, similar to those proposed for use, that have been in successful service for a minimum period of [5] [\_\_\_\_\_] years. Identify purchaser, address of installation, service organization, and date of installation.

Ensure floor system applicators are experienced in the application of troweled [walnut-shell] [\_\_\_\_\_] aggregate thin-set floor topping.

#### 1.5.3 Sampling

Submit [hardboard mounted epoxy flooring](#) samples not less than 12 inch square for each required color.

Provide panels showing nominal thickness of finished toppings, color, and texture of finished surfaces. Finished floor toppings and the approved samples are to match in color and texture.

#### 1.6 WARRANTY

Submit a [2] [\_\_\_\_\_] year written [warranty](#) for all materials and installation work.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Submit [installation drawings](#) for heavy duty epoxy flooring systems clearly designating the areas of application and the installation plan. Include in the installation plan, methods to control sand and dust if sand blasting is required.

[ Submit [fabrication drawings](#) for heavy duty epoxy flooring Systems consisting of fabrication and assembly details to be performed in the factory.

#### ]2.2 MATERIALS

##### 2.2.1 Mixes

##### 2.2.1.1 Epoxy-Resin Binder/Matrix

Provide a clear two-component compatible system epoxy resin binder consisting of: (1) a liquid blend of a biphenyl-based epoxy resin and an aliphatic polyglyceride ether, and (2) a liquid blend of two modified amine curing agents, which individually cures the epoxy resin at room temperature to a glossy smooth film. Ensure the two components and the cured epoxy binder have the following physical properties:

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
COMPONENT A (EPOXY RESIN)		
Viscosity (kinematic), at 77 degrees F, centipoises	ASTM D445	3000 to 5000
Weight per epoxide, grams	ASTM D1652	205 to 225
Color (Gardner Color Scale), maximum	ASTM D1544	5
Weight per gallon, pounds	ASTM D1475	9.46 - 9.56
COMPONENT B (CURING AGENT)		
Viscosity (kinematic), at 77 degrees F, centistokes	ASTM D445	75 to 125
Weight per gallon, pounds	ASTM D1475	7.50 to 7.60
Color (Gardner Color Scale), maximum	ASTM D1544	8

#### 2.2.1.2 Cured Epoxy Binder

Provide a cured epoxy binder with the following properties.

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
Tensile strength, psi* at test temperature: 77 degrees F	ASTM D638	4500 to 6500
Tensile elongation, percent* at test temperature: 77 degrees F	ASTM D638	20 to 40
Water absorption, percent 24 hours at 77 degrees F, maximum	ASTM D570	0.40
Hardness, Shore D	ASTM D2240	74 to 82
Linear shrinkage, inch/inch maximum	ASTM C881/C881M	0.006
Shrinkage, glass bow, inch divergence, maximum	ASTM A990/A990M	0.016

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
Coefficient of linear thermal expansion, inch/inch/degree C, maximum	ASTM D696 0 degrees C to 40 degrees C	200 X 10 <sup>-6</sup>
Gel time/peak exotherm at 77 degrees F, 100 gm mass in 4 ounce metal container	ASTM D2471	20 to 40 minutes at 300 degrees F, maximum
*1/8 inch thick castings		
**1/8 by 1 by 3 inch castings, aged in forced draft oven		

[2.2.1.3 Aggregate

Provide aggregate recommended by the resinous flooring manufacturer and approved by the Contracting Officer. Deliver aggregate to the site in three separate package gradations for blending. Gradations are:

SIEVE SIZE	PERCENT	
	MAXIMUM	MINIMUM
GRADATION NO. 1		
Retained on No. 6	0.0	-
Passing No. 6, retained on No. 8	5.0	0.0
Passing No. 8, retained on No. 12	100.0	74.0
Passing No. 20	1.0	-
GRADATION NO. 2		
Retained on No. 16	0.0	-
Passing No. 16, retained on No. 18	5.0	0.0
Passing No. 18, retained on No. 40	100.0	85.0
Passing No. 40, retained on No. 60	9.0	0.0
Passing No. 60	1.0	-
GRADATION NO. 3		
Retained on No. 20	0.0	-
Passing No. 20, retained on No. 35	5.0	0.0



SIEVE SIZE	PERCENT	
	MAXIMUM	MINIMUM
Passing No. 35, retained on No. 60	100.0	80.0
Passing No. 60, retained on No. 100	13.0	0.0
Passing No. 100	2.0	-

#### ]2.2.1.4 Surface Sealing Coat

Provide nonnumbering aliphatic or aromatic moisture-curing polyurethane surface sealer into which has been incorporated a flattening agent. Add flattening agent not more than 24 hours prior to actual application of the coating. Ensure cured coating with flattening agent yields 60-degree specular gloss of 10 to 20 when tested in accordance with [ASTM D523](#).

### PART 3 EXECUTION

#### 3.1 PREPARATION

Prior to applying resinous flooring material, inspect substrate and immediately report any unsatisfactory conditions that exist and repair.

Verify that the concrete substrates are dry and the moisture-vapor emissions are within acceptable levels according to the manufacturer's written instructions.

- [ Anhydrous Calcium Chloride Test: [ASTM F1869](#). Proceed with application of resinous flooring only after substrates have a maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft.][4.5 lb of water/1000 sq ft.][Insert emission rate] of slab area in 24 hours.
- ][ Relative Humidity Test: Use in situ probes, [ASTM F2170](#). Proceed with installation only after substrates have a maximum [75] [Insert number] percent relative humidity level measurement.
- ][ Alkalinity and Adhesion Testing: Verify that concrete substrates have a pH within an acceptable range. Perform tests recommended by the manufacturer. Proceed with the application only after the substrates pass testing.]

##### 3.1.1 Safety Precautions

Prior to application in confined spaces of toppings and coatings containing flammable or toxic properties, institute safety precautions recommended by the manufacturer of the product.

Erect "NO SMOKING" signs, and prohibit smoking or use of spark- or flame-producing devices within 50 feet of any mixing or placing operation involving flammable materials.

Provide the personnel required to handle, mix, or apply toppings containing toxic or flammable properties with such items of personal protective equipment and apparel for eye, skin, and respiratory protection as are recommended by the manufacturer of the product. Ensure all personnel are

trained in the appropriate use and wearing of personal protection equipment.

### 3.1.2 Protection of Adjacent Surfaces

In addition to the protection of adjacent surfaces during installation, provide areas used to store and mix materials with a protective covering under the materials. After application of the sealer coats, protect finished flooring during the remainder of the construction period. In areas of expected minimum or moderate traffic, cover floors with [ 70 pound kraft paper] [ a 30-30-30 waterproof kraft paper] [\_\_\_\_\_], with strips taped together and edges secured to prevent roll-up. Place vegetable fiberboard, plywood, or other suitable material that does not mar the flooring over the paper to protect areas used as passages by workmen and areas subject to floor damage because of subsequent building operations. Upon completion of construction, remove the protection, clean flooring and, where necessary, repair, reseal, or both, at no additional cost to the Government.

### 3.1.3 Concrete Subfloor

#### [3.1.3.1 New Concrete Floors

Do not commence installation of the floor topping until the concrete has cured a minimum of 28 calendar days. Verify that the concrete floor is straight, properly sloped, and has [rough] [broom] [wooden float] type finish. Ensure that the concrete is moist cured with burlap or polyethylene. Before applying the prime coat, clean the concrete surface by an approved method.

#### ] [3.1.3.2 Existing Concrete Floors

Clean existing concrete floors, with hard troweled or contaminated areas in conformance with ASTM D4259. Ensure the concrete is free of all paint, sealers, curing agents, oil, grease, moisture, dirt or any other contaminants. Remove any loose or corroded segments of existing concrete. Patch with a grouting compound as recommended by the resinous flooring manufacturer. Fill all cracks with an elastomeric jointing compound compatible with the resinous flooring system used.

#### ] [3.1.4 Steel Subfloor

Clean surfaces of grease, rust, and mill scale by dry sand blasting in accordance with SSPC SP 6/NACE No.3. Prime all surfaces with a primer as recommended by the resinous flooring manufacturer, the same day or before there are any visible signs of oxidation, which ever is sooner. Using other means of surface preparation is optional, as approved by the Contracting Officer, provided the degree of cleanliness and the profile obtained by sand blasting is equivalent. Power brushing is not permitted.

#### ] [3.1.5 Mixing Of Materials

Select the job mix proportions on the trial batch proportions used to prepare the floor topping samples as submitted and approved.

Use mechanical equipment for mixing of materials in accordance with the manufacturer's instructions.

Use rotating paddle-type masonry mortar mixers for preblending the three sizes and color pigment, if any, of the walnut shell aggregate and addition of the mixed epoxy resin binder. Ensure mixing times are as recommended by

the materials supplier(s), provided mixing times result in homogeneous mixtures. Limit quantity of material mixed at one time to that which can be applied and finished within the working life of the mixtures. Verify that the temperature of materials at the time of mixing are between 65 and 85 degrees F.

### 3.2 APPLICATION

#### 3.2.1 Areas of Application

Anchor plates set with the top surface at or above the finished epoxy floor level do not require coverage with this flooring material. Extend flooring under equipment, except when the equipment base is indicated to be flush against the structural floor. Cover and/or mask surfaces not to receive the epoxy floor topping, such as equipment or cabinets installed prior to surface-preparation efforts and adjacent to the flooring installation.

#### 3.2.2 Application of Prime Coat and Troweling

Combine the epoxy binder components A and B in the proportions specified by the manufacturer to form a clear compatible system immediately on mixing. Cure combined components to a clear film possessing a glossy, non-greasy surface at relative humidities less than 80 percent, having the following properties after curing 24 hours at 77 degrees F, followed by 24 hours at 125 degrees F:

Ensure that the prepared subfloor surface is dry and at a temperature of not less than 60 degrees F when application of the floor topping is initiated. Immediately before application of the prime/scratch coat on the prepared surface, remove dust or other loose particles by blowing with compressed air or vacuum cleaned. Use only an air compressor equipped with an efficient oil-water trap to prevent oil contamination or wetting of surface.

Apply a thin roller coat of the epoxy binder specified to the prepared subfloor as a prime coat. As an aid to placing, compacting, and finishing the floor topping, form a scratch coat by sprinkling a minimum quantity of the walnut shell aggregate on the prime coat surface immediately following the prime coat application. Prior to application of the prime/scratch coat, fill cracks in the concrete per manufacturer's instructions, and make provisions to keep control or expansion joints open.

Place the floor topping prior to final gelling of the prime/scratch coat. Immediately after the materials are mixed as specified, dump the mixture in the placement area and spread to prolong troweling life. Screed or rough trowel placed materials to the specified thickness and then compact by the use of a smooth roller prior to finish troweling to a nominal thickness of 3/16 inch plus or minus 1/16 inch. Ensure all finished surfaces are free of ridges, hollows (bird-baths), trowel marks, and smoothness varies no more than 1/8 inch when tested with an 8 foot straightedge. Make provisions to maintain the work areas in a relatively dust-free environment during curing of the topping.

#### 3.2.3 Sealer Coat

After the floor topping has set firmly (approximately 6 to 16 hours depending on subfloor temperature) in a relatively dust-free environment, apply two thin coats of the sealer coat, by means of brush, roller, squeegee, or notched trowel to provide a pore-free, easy-to-clean surface.

At the time of sealer application, ensure that the surface is dust-free. Depending on relative humidity, allow the applied sealer to cure to a tack-free condition in 2 to 4 hours. Do not apply second coat until after the initial coat has cured to a tack-free, hard film. Maintain topping areas in a relatively dust-free environment during curing of the sealer coats.

#### [3.2.4 Integral Cove Base

Provide a [4] [\_\_\_\_\_] inch high cove base to all wall surfaces as indicated on the drawings. Install so as to provide a [1/2] [\_\_\_\_\_] inch radius at the juncture of the floor and the wall.

#### ]3.3 FIELD QUALITY CONTROL

##### 3.3.1 Repairing

Remove and replace damaged or unacceptable portions of completed work with new work to match adjacent surfaces at no additional cost to the Government.

#### 3.4 ADJUSTING AND CLEANING

Clean surfaces of the new work, and adjacent surfaces soiled as a result of the work. Remove all equipment, surplus materials, and rubbish associated with the work from the site.

-- End of Section --

## SECTION 09 67 23.14

## CHEMICAL RESISTANT RESINOUS FLOORING

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C307	(2018) Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
ASTM C413	(2018) Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
ASTM C531	(2018) Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing, and Polymer Concretes
ASTM C579	(2018) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C580	(2018) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C722	(2018) Standard Specification for Chemical-Resistant Resin Monolithic Floor Surfacing
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D4060	(2019) Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM E162	(2021) Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

**CDPH SECTION 01350** (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 99** (2021; TIA 20-1) Health Care Facilities Code

## NATIONAL TERRAZZO AND MOSAIC ASSOCIATION (NTMA)

**NTMA Info Guide** (2017) Terrazzo Reference Guide

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

**SCAQMD Rule 1113** (2016) Architectural Coatings

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**29 CFR 1910** Occupational Safety and Health Standards

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Flooring Systems; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Sealer and Resin; G[, [\_\_\_\_\_]]

Floor Surfacing; G[, [\_\_\_\_\_]]

Conductive Sparkproof Flooring; G[, [\_\_\_\_\_]]

Indoor Air Quality for Primer; S

Indoor Air Quality for Top Coating; S

Indoor Air Quality for Sealer And Resin; S

Mixing; G[, [\_\_\_\_\_]]

## SD-04 Samples

Flooring Systems; G[, [\_\_\_\_\_]]

## SD-06 Test Reports

Testing; G[, [\_\_\_\_]]

#### SD-07 Certificates

Qualifications of Installer; G[, [\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Application; G[, [\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Flooring Systems; G[, [\_\_\_\_]]

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualifications of Installer

Perform installation by an applicator approved by the manufacturer of the floor surfacing materials. Furnish a written statement from the manufacturer detailing the Qualifications of Installer.

#### 1.3.2 Shop Drawings

Submit drawings indicating the type and layout of the flooring system for approval.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the materials to the project site in unopened bags and containers clearly labeled with the name of the manufacturer, type of material, batch number, and date of manufacture. Store materials, other than aggregates, away from fire, sparks, or smoking areas. Maintain the storage area between 50 and 90 degrees F.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Maintain the ambient room and floor temperatures at 65 degrees F, or above, for a period extending from 48 hours before installation until one week after installation. Cure concrete for at least 28 days and keep it free of water for at least 7 days prior to receiving surfacing in accordance with ASTM D4263. Measure and insure moisture content of wood substrates between 8 and 10 percent prior to application.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Provide materials (except aggregate) used in the flooring from a single manufacturer. Furnish and install [trowel applied type epoxy finish of 1/4 inch thickness with properties and chemical resistance conforming to the requirements specified in NTMA Info Guide.] [trowel or spray applied [ 1/6 inch] [ 1/8 inch] [ 1/4 inch] thick, epoxy, polyester, or other resinous material conforming to ASTM C722 with [Type A surfacings (chemical resistance and moderate to heavy traffic resistance)] [Type B surfacings (mild chemical resistance and severe thermal shock stability)]] resin-based flooring. Meet the following material requirements:

### 2.1.1 Primer

Type recommended by the manufacturer to penetrate into the pores of the substrate and bond with the floor surfacing matrix to form a permanent monolithic bond between substrate and surfacing matrix. Primer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for primer](#).

### 2.1.2 Aggregate

Provide [silica sand, quartz, granite, or other suitable chemical resistant material having a Mohr's hardness of not less than 6.0] [angular, translucent quartz covered with a colored inorganic coating as [indicated] [selected from manufacturer's standard aggregates]] aggregate.

### 2.1.3 Binder

Provide [synthetic rubber latex or resin emulsion] [thermo-setting epoxy] [or] [medium reactive nonthixotropic modified polyester] binder.

### 2.1.4 Fillers

If required, provide inert silica, quartz or other hard aggregate material fillers as recommended by the flooring manufacturer. Furnish fillers in the quantity necessary to impart the required color and physical characteristics. Provide a filler containing sufficient fines to obtain an even-textured, nonslip type of surface on the finished topping.

### 2.1.5 Top Coating

Furnish [clear] [[\_\_\_\_\_] color] coating of type recommended by the manufacturer. Floor top coating products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for top coating](#).

## 2.2 FLOORING SYSTEMS

Submit cured samples of each floor finish or color combination and Data Package 1 in accordance with Section [01 78 23 OPERATION AND MAINTENANCE DATA](#). The complete systems, after curing, must have the following properties when tested in accordance with the test methods listed for each property.

### 2.2.1 Latex or Resinous Emulsion Matrix Floor Surfacing

#### 2.2.1.1 Compressive Strength

[ASTM C579](#), 4500 psi minimum at 7 days.

#### 2.2.1.2 Tensile Strength

[ASTM C307](#), 600 psi minimum at 7 days.



## 2.2.1.3 Flexural Strength

ASTM C580, 800 psi minimum at 7 days.

## 2.2.1.4 Thermal Coefficient of Expansion

ASTM C531; 0.01 mil per inch per degree F maximum.

## 2.2.1.5 Bond Strength

200 psi minimum with 100 percent concrete failure.

## 2.2.1.6 Flame Spread Index

ASTM E162, 4.0 maximum.

## 2.2.1.7 Smoke Developed

ASTM E162, 0.4 gm maximum.

## 2.2.1.8 Abrasion Resistance

ASTM D4060; 30 mg weight loss.

## 2.2.1.9 Moisture Absorption

ASTM C413; 3.5 percent maximum.

## Chemical Resistance

ASTM D1308; no effect when exposed to the following reagents for 7 days:

Acetic Acid: 5 percent solution  
Ammonium Hydroxide: 10 percent solution  
Citric Acid: 5 percent solution  
Coffee  
Cola Syrup  
Isopropyl Alcohol  
Mineral Oil  
Sodium Hydroxide: 5 percent solution  
Tri-Sodium Phosphate: 5 percent solution  
Urea: 6.6 percent solution

## 2.2.2 Epoxy Matrix Floor Surfacing

## 2.2.2.1 Compressive Strength

ASTM C579; 10,000 psi minimum at 7 days.

## 2.2.2.2 Tensile Strength

ASTM C307; [600] [1500] psi minimum at 7 days.

## 2.2.2.3 Flexural Modulus of Elasticity

ASTM C580; [250,000] [500,000] psi minimum at 7 days.

## 2.2.2.4 Thermal Coefficient of Expansion

ASTM C531; 0.00004 inches per inch per degree F maximum.

#### 2.2.2.5 Shrinkage

ASTM C531; 0.5 percent maximum.

#### 2.2.2.6 Bond Strength

300 psi minimum with 100 percent concrete failure ( 2500 psi Compressive Strength Concrete).

#### 2.2.2.7 Flame Spread Index

ASTM E162; 25 maximum.

#### 2.2.2.8 Smoke Deposited

ASTM E162; 4 mg maximum.

#### 2.2.2.9 Abrasion Resistance

ASTM D4060; 15 mg maximum weight loss.

#### 2.2.2.10 Moisture Absorption

ASTM C413; 1.0 percent maximum.

#### 2.2.2.11 Chemical Resistance

ASTM D1308; no effect when exposed to the following reagents for 7 days:

Acetic acid: 5 percent solution  
Ammonium Hydroxide: 10 percent solution  
Citric Acid: 5 percent solution  
Coffee  
Cola Syrup  
Isopropyl Alcohol  
Mineral Oil  
Sodium Hydroxide: 5 percent solution  
Tri-Sodium Phosphate: 5 percent solution  
Urea: 6.6 percent solution

#### 2.2.3 Polyester Matrix Floor Surfacing

##### 2.2.3.1 Compressive Strength

ASTM C579; [8000] [10,000] psi minimum at 7 days.

##### 2.2.3.2 Tensile Strength

ASTM C307; [600] [1500] psi minimum at 7 days.

##### 2.2.3.3 Flexural Modulus of Elasticity

ASTM C580; [500,000] [1,000,000] psi minimum at 7 days.

##### 2.2.3.4 Thermal Coefficient of Expansion

ASTM C531; 0.00004 inches per inch per degree F maximum.

## 2.2.3.5 Shrinkage

ASTM C531; [0.6] [1.0] percent maximum.

## 2.2.3.6 Bond Strength

300 psi minimum with 100 percent concrete failure.

## 2.2.3.7 Flame Spread Index

ASTM E162; 25 maximum.

## 2.2.3.8 Smoke Deposited

ASTM E162; 4 gm maximum.

## 2.2.3.9 Abrasion Resistance

ASTM D4060; no more than 1.0 mil loss of thickness.

## 2.2.3.10 Porosity

ASTM D4060; no more than 8 percent gain in weight and no evidence of cracking, peeling, blistering, or loss of adhesion.

## 2.2.3.11 Impact Resistance

ASTM D4060; no evidence of cracking, spalling, or loss of adhesion.

## 2.2.3.12 Fungistatic and Bacteriostatic Resistance

ASTM D4060; no support for growth of fungus or bacteria.

## 2.2.3.13 Ultraviolet Light Resistance

ASTM D4060; no evidence of chalking, cracking, peeling, blistering, or loss of adhesion.

## 2.2.3.14 Thermal Shock Resistance

ASTM D4060; no evidence of cracking, peeling, blistering, spalling, or loss of adhesion.

## 2.2.3.15 Stain Resistance

ASTM D4060; no permanent staining.

## 2.2.3.16 Adhesion

ASTM D4060; 90 percent failure of concrete substrate.

## 2.2.3.17 Chemical Resistance

ASTM D1308; no effect when exposed to the following reagents for 7 days.

Acetic Acid: 5 percent solution  
Ammonium Hydroxide: 10 percent solution  
Citric Acid: 5 percent solution

Coffee  
Cola Syrup  
Isopropyl Alcohol  
Mineral Oil  
Sodium Hydroxide: 5 percent solution  
Tri-Sodium Phosphate: 5 percent solution  
Urea: 6.6 percent solution

### 2.3 CONDUCTIVE SPARKPROOF FLOORING

Trowel or spray apply conductive sparkproof industrial resin-based flooring [ 1/16 inch] [ 1/8 inch] [ 1/4 inch] thick, epoxy, polyester, or other resinous material conforming to [ASTM C722](#) with [Type A surfacings (chemical resistance and moderate to heavy traffic resistance)] [Type B surfacings (mild chemical resistance and severe thermal shock stability)]. Ground conductive flooring and conform to the requirements for conductive flooring of [NFPA 99](#).

### 2.4 SEALER AND RESIN

Provide a sealer product recommended by the industrial resin-based flooring manufacturer; when applied to the resin topping and dried, it must be nonslip and resistant to staining and suitable for the type application indicated. Floor resin and sealer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation for [Indoor Air Quality for Sealer and Resin](#).

### 2.5 ANTIMICROBIAL

Treat industrial resin-based flooring to be resistant to fungi and bacteria.

### 2.6 COLOR

Provide color [as indicated] [in accordance with Section [09 06 00 SCHEDULES FOR FINISHES](#)] [\_\_\_\_\_].

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

[Completely remove existing resilient flooring and adhesive by scraping.]  
[Remove all dirt, dust, debris, and other loose particles by sweeping or vacuum cleaning.] Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

#### [3.1.1 Concrete Surfaces

##### [3.1.1.1 Mechanical Cleaning

Completely remove dirt, wax, paint, laitance, and [\_\_\_\_\_] by grinding with a terrazzo machine, sanding with coarse open grid sandpaper, sand blasting, chipping, bush hammering, or wire brushing.

##### ] [3.1.1.2 Steam Cleaning

Completely remove all animal fats, grease, oil, wax, and [\_\_\_\_\_] using a high pressure steam cleaner equipped with a soap injection system. Scrape the surface to remove any build-up of debris. Then thoroughly saturate the surface with hot caustic solution. Allow the solution to remain on the floor for 15 to 20 minutes. Apply steam, with caustic, over the presoaked area until all contamination is removed. Leach the caustic residue from the surface using one or more applications of steam without caustic. Flush the floor with warm water.

] [3.1.1.3 Paint Stripping

Brush or spray on a paint stripping material that has been demonstrated to effectively remove the paint. Leave the stripping material on the surface until the paint has softened or blistered. Remove paint by scraping, brushing, or wiping. Rinse the surface in accordance with the stripping material manufacturer's recommendations. Avoid strippers containing toxic methylene chloride.

] [3.1.1.4 Acid Etching

Apply a 10 percent solution of muriatic acid at a rate of **one quart/each 10 square feet** of concrete surface. Allow the solution to stand until it stops bubbling but not less than 5 minutes. Remove the acid and wash the surfaces several times, as required, to remove all traces of the acid. Always dilute acid by pouring into water. Use face shield rubber gloves, and other safety equipment when using acids, alkalis, or solvents.

] [3.1.1.5 Air Drying

After cleaning, allow concrete surface to air dry thoroughly prior to application of surfacing. Blowers or oil free compressed air may be used. Do not use flame-drying methods. Prior to application of surfacing, test concrete surface for excessive moisture in at least two locations. Place rubber mats at each location with smooth side against concrete and place weight on top of mat to hold in position and ensure contact with concrete. Polyethylene with all edges taped may be used in lieu of mats. After 8 hours remove mat or sheeting and examine floor surface for moisture accumulation. If tests indicate accumulation of moisture at either location, perform additional air drying until additional tests show no moisture accumulation.

]] 3.1.2 Plywood

For new plywood substrates, provide exterior grade plywood with exterior grade glue nailed with annular ring or spiral nails. Sand the plywood to remove all latent contaminants. Sweep or vacuum surfaces to remove all sanding debris. Tape joints with **4 inch** wide glass fiber reinforced tape.

3.1.3 Ceramic Tile

Remove all fats, oils, grease, or soap scum using a caustic solution of **one pound** of caustic soda to **one gallon** of water. Allow the solution to stand on the surface for at least one hour then scrub with steel brushes or steel wool. Mop up the caustic solution, neutralize it with a 10 percent muriatic acid solution, and thoroughly rinse the residue from the surface. Test glazed tile a deglazing agent as recommended by the flooring manufacturer and sanded or acid etched to roughen the surface sufficiently to obtain a good bond. Sweep or vacuum surfaces to remove all sanding debris. Use face shield, rubber gloves, and other safety equipment when

using acids, alkalis, or solvents.

#### 3.1.4 Substrate Cracks, Spalls, Joints, and Depressions

Fill all cracks, joints, spalls, and other depressions in the substrate with a latex underlayment, as recommended by the manufacturer compatible with the floor surfacing material.

### 3.2 MIXING

Proportion and mix the floor surfacing components in accordance with the manufacturer's instructions. Submit flooring manufacturer's descriptive data, mixing, proportioning, and installation instructions. Include maintenance literature for resinous flooring.

### 3.3 APPLICATION

Submit complete instructions for application of flooring system including any precautions or special handling instructions required to comply with OSHA 29 CFR 1910-Subpart Z. Apply primer, floor surfacing, and seal coat in accordance with the manufacturer's recommendations and the following requirements.

#### 3.3.1 Primer

Apply primer uniformly over the entire area to receive floor surfacing using clean rubber squeegees or clean steel trowels. Do not allow primer to collect in depressions. Allow primer to dry thoroughly before the next coat is applied. Reprime porous areas or areas where primer has dried.

#### 3.3.2 Floor Surfacing

Apply mixed surfacing material to provide a finish floor surfacing not less than [\_\_\_\_\_] inch thick. The entire surfacing in any one room or area must be [placed in one continuous operation without use of cold joints or divider strips] [one continuous operation except for placement of divider strips at structural floor control joints or as indicated]. All surfaces must be flush, true to plane and line, and level within 1/4 inch in 10 feet.

#### 3.3.3 Seal Coat

Apply seal coat uniformly covering all surfaces after floor surfacing has cured and as recommended by the supplier.

### 3.4 TESTING

Submit reports of tests for conductive sparkproof flooring, including analysis and interpretation of test results. Properly identify each report. Identify and record the test methods used.

#### 3.4.1 Electrical Resistance

Test the flooring between 30 and 45 days after flooring installation is completed, and prior to its use, in accordance with paragraph 12-4.1.3.8(b) (7) of NFPA 99. The resistance of the floor at any one location must be more than 5,000 ohms in areas with 110 volts service, more than 10,000 ohms in areas with 220 volt service, and average less than 1,000,000 ohms and more than 25,000 ohms in all areas. Perform tests using a technician experienced in such work.

### 3.4.2 Spark Resistance

Test the floor for spark resistance by stroking the floor vigorously with a 12 inch hardened steel file in a 3 foot arc. Perform the test for each 80 square feet of floor area. Perform the tests in a darkened space and only when the relative humidity of the atmosphere within the space does not exceed 50 percent. The floor must not produce a spark when tested under these conditions.

### 3.5 PROTECTION

Allow surfacing to set for a minimum period of 48 hours before traffic is allowed on the floor. Protect finished flooring from traffic by covering with 30 pound building paper or other equally effective means until final acceptance of the project.

-- End of Section --

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## SECTION 09 67 23.15

## FUEL RESISTIVE RESINOUS FLOORING, 3-COAT SYSTEM

02/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C679	(2015; R 2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D3925	(2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4541	(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D6237	(2019) Standard Guide for Painting Inspectors (Concrete and Masonry Substrates)
ASTM E11	(2022) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

## INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI 310.2R	(2013) Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair
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## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2015) Quality Management Systems- Requirements
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## MASTER PAINTERS INSTITUTE (MPI)

MPI 211 (2018) Floor Coating, Primer, Thin Film, for Aircraft Maintenance Facilities

MPI 212 (2018) Floor Coating, Thin Film, for Aircraft Maintenance Facilities

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC QP 5 (2012) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies

SSPC QP 8 (2015) Standard Procedure for Evaluating the Qualifications of Contracting Firms that Install Polymer Coatings, Surfacing, Linings or FRP Composites on Concrete and Other Cementitious Substrates

SSPC QS 1 (2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System

SSPC-TU 2/NACE 6G197 (1997) Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134 Respiratory Protection

29 CFR 1910.1000 Air Contaminants

29 CFR 1926.59 Hazard Communication

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Joint Sealant; G[, [\_\_\_\_]]

Thin Film Flooring System; G[, [\_\_\_\_]]

White Aluminum Oxide Non-Skid Grit; G[, [\_\_\_\_]]

SD-05, Design Data

Environmental Control System

SD-06 Test Reports

Joint Sealant Test Report; G[, [\_\_\_\_]]

Primer Coat; G[, [\_\_\_\_\_]]

Urethane Topcoat; G[, [\_\_\_\_\_]]

White Aluminum Oxide Non-Skid Grit; G[, [\_\_\_\_\_]]

Patch Test Demonstration; G[, [\_\_\_\_\_]]

Daily Inspection Report; G[, [\_\_\_\_\_]]

Adhesion Testing; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Coating Work Plan; G[, [\_\_\_\_\_]]

Joint Sealant Certificates; G[, [\_\_\_\_\_]]

Thin Film Flooring System Certificates; G[, [\_\_\_\_\_]]

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coating Inspection Company

Qualifications of QC Specialist Coating Inspector

Qualifications of Coating Contractors; G[, [\_\_\_\_\_]]

Warranty; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Joint Sealant Manufacturer's Instructions; G[, [\_\_\_\_\_]]

Thin Film Flooring System Manufacturer's Instructions; G[, [\_\_\_\_\_]]

Water-Based Alkaline Degreaser; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Inspection Logbook; G[, [\_\_\_\_\_]]

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party PCS. Submit documentation that the specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS must remain certified during the entire project, and the Contracting Officer must be notified of any change in certification status within 10 days of the change. The PCS must not be the designated coating inspector.

### 1.3.2 Coating Work Plan

- a. Include Coating Work Plan in Quality Control Plan.
- b. Provide procedures for reviewing Contract Documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.
- c. Provide procedures for verification of key processes during Initial Phase to ensure that Contract requirements can be met. Key processes must include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.
- d. Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of non-compliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with Contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.
- e. [Provide procedures for determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.] [\_\_\_\_\_]
- f. Provide procedures for correcting non-compliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well as to avoid delays in production. Provide procedures for repairing defects in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to correct coating thickness non-compliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.
- g. If a procedure is based on a proposed or approved request for deviation, the deviation must be referenced. Changes to procedures must be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

### 1.3.3 Design Data

#### 1.3.3.1 Environmental Control System

Submit design details of the proposed environmental control system to include ventilation, humidity control, and temperature regulation. Provide calculations for humidity control during separate surface preparation and coating application procedures, ventilation requirements during coating application, and maximum allowable coating application rates to coincide with ventilation. Include basis of design data on local conditions. Provide equipment layout sketches and procedures showing function of each piece of equipment and fail-safe measures. A Certified Industrial Hygienist must approve calculations, work procedures and personal

protective equipment.

#### 1.3.4 Test Reports

##### 1.3.4.1 Joint Sealant Test Report

Submit test results that confirm sealant complies with the requirements of Table Ia. Samples must have been tested within the last three years.

##### 1.3.4.2 Daily Inspection Report

Submit one copy of the daily inspection report to the Contracting Officer within 24 hours of the date recorded.

#### 1.3.5 Certificates

##### 1.3.5.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.3.5.2 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company performing all coating inspection functions is certified by SSPC to the requirements of **SSPC QP 5** prior to Contract award. The coating inspection company submitted and approved must remain and not changed through completion of the Contract. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in coating inspection company certification status. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from SSPC and furnish a copy of all inspection reports.

##### 1.3.5.3 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to **SSPC QP 5**, Level II, by the selected coating inspection company. Each inspector must remain employed by the coating inspection company while performing any coating inspection functions. In addition to the handwritten records, the inspector must employ an electronic reporting program with functionality as outlined in Table II. The Administrator must be the designated Government Representative for the project.

##### 1.3.5.4 Qualifications of Coating Contractors

All Contractors that perform surface preparation or coating application must be certified to **SSPC QP 8** and should also be **SSPC QS 1** certified prior to Contract award and must remain certified while accomplishing any surface preparation or coating application. The painting Contractors must remain so certified for the duration of the project. If a Contractor's

certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site audits from SSPC and furnish a copy of all audit reports.

[ For OCONUS, non-US territories where documentation is provided that certified **SSPC QP 8** with or without **SSPC QS 1** Contractors did not bid and are not available, all Contractors that perform surface preparation or coating application must be certified to **ISO 9001** prior to Contract award, and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from the ISO certifying organization and furnish a copy of all inspection reports.

] [Minimum requirements for the installation Contractor are as follows: Completed three or more jobs within the past two years applying the specified materials to concrete surfaces in which the total area exceeds **200,000 square feet**. Submit documentation listing location of work, point of contact at job site, total square footage of applied materials, listing of both materials and equipment used, and validation from coating manufacturer documenting quality of materials purchased per job for work totaling **200,000 square feet** within the past two years. In addition to the above requirements, be certified by the material manufacturer(s) to install the submitted coatings and sealant. Submit copy of certificates.

#### ] 1.3.5.5 **Joint Sealant Certificates**

Submit literature documenting the past performance of the sealant's use in automotive or aircraft maintenance shops. Minimum requirements are two or more maintenance shops with joint work totaling **10,000 linear feet** where the sealant has performed for two years with less than 1 percent combined sealant failures and defects. List location of shops, total linear feet of sealant applied per shop, shop point of contact, date sealant was applied, and the name of the installed sealant material.

#### 1.3.5.6 **Thin Film Flooring System Certificates**

Provide manufacturer's certification of conformance to Contract requirements.

[ Submit literature documenting the past performance of the coating system's use in aircraft maintenance shops and over floors with high rates of Moisture Vapor Emission (MVE). Minimum requirements are two or more aircraft maintenance shops totaling **34,000 square feet** where the coating system has performed for two years with less than 0.05 percent combined premature coating failures, material defects and surface discoloration; no more than 0.03 percent discoloration from aviation chemicals, tire plasticizers, and UV exposure. Provide a minimum of two additional case histories where successful installation occurred on floor slabs with no less than **3.5 pounds moisture per 24 hours, 1000 square feet**. List location of shops, total coated area per shop, shop point of contact, date

coating system was applied, successful installation to concrete with high MVE, and the names of the installed coating materials.

#### ]1.3.6 Product Data

##### 1.3.6.1 Joint Sealant Manufacturer's Instructions

Submit manufacturer's printed instructions to include detailed application procedures, minimum and maximum application temperatures, and curing procedures. In accordance with 29 CFR 1926.59, include Safety Data Sheets (SDS) for the sealant to be used at the job site.

##### 1.3.6.2 Thin Film Flooring System Manufacturer's Instructions

Submit manufacturer's printed instructions to include detailed mixing, minimum and maximum application temperatures, acceptable atmospheric and interior climatic conditions, application procedures, curing procedures, and procedures for maintenance cleaning of flooring system. Provide explicit instructions detailing surface preparation, recoat windows and remedial actions in case recoat windows are missed, and, if applicable, solvent-wiping between coats with acceptable types and grades of solvents. In accordance with 29 CFR 1926.59, include SDSs for the coatings to be used at the job site.

##### 1.3.6.3 Water-Based Alkaline Degreaser

Submit manufacturer's printed instructions to include detailed mixing, rate of dilution, application procedures, and rinsing procedures. In accordance with 29 CFR 1926.59, include SDSs for the water-based alkaline degreaser to be used at this job site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Store coatings and sealant in spaces with temperatures from 40 degrees F to 75 degrees F. Inspect materials on site for damage prior to use. Return to manufacturer packaged materials in dented, rusty, or leaking containers. Conduct testing by manufacture of returned materials with an expired shelf life and if compliant, reissue a shelf life extension.

#### 1.5 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Follow the coating manufacturer's written safety precautions throughout mixing, application, and curing of coatings. Comply with respiratory protection requirements in 29 CFR 1910.134 and safe levels of airborne contaminants in 29 CFR 1910.1000.

#### 1.6 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D4541, ASTM D6237, SSPC-TU 2/NACE 6G197, and ICRI 310.2R, including replica standards ICRI 310.2R CSP 1 through CSP 9, at the job site.

#### 1.7 PATCH TEST DEMONSTRATION

Prior to the submitted flooring system's approval, apply the complete coating system to a 10 foot by 10 foot square section of concrete as prepared in accordance with PART 3 EXECUTION. Within this area, perform three adhesion tests as described in the paragraph ADHESION TESTING. If

adhesion testing produces cohesive failures within the concrete, no less than 40 mils concrete removed over 95 percent of each pull-off coupon, or adhesion more than 400 psi, patch test adhesion is acceptable. If concrete surface preparation was insufficient, apply an additional coating system patch to properly prepared concrete followed by the above adhesion testing. If adhesion results are unacceptable for both the topcoats and the primer, submit a new coating system manufactured by a different coating vendor. Apply a patch of the new coating system and subject patch to the above requirements for adhesion prior to approval. If customer is not satisfied with the non-skid grit application, adjustments to the specifications can be made. Grit coarser than No. 60 aluminum oxide is not recommended.

## 1.8 WARRANTY

Warranty materials and workmanship for a minimum period of one year following coating and sealant application. The following terms and conditions form a part of the warranty: If the applied coating system develops either blisters (chemical), checks, softening, or lifting within one year following application, rework each area at Contractor's expense. The following conditions are excluded from the warranty: A) concrete cracking, flooring system mirrors cracks in concrete; B) cosmetic imperfections due to scratching and gouging; C) application to metallic concrete finishes; and D) application to concrete with a rate of Moisture Vapor Emission (MVE) greater than 3.5 pounds moisture per 24 hours, 1000 square feet. If the coating system's adhesion is in question, perform one adhesion test per 100 square feet as described in the paragraph ADHESION TESTING. To satisfy the warranty, each adhesion test must produce cohesive failures, concrete removal over 95 percent of each pull-off coupon, or adhesion no less than 400 psi. Require two additional adhesion tests to confirm results for each area failing to meet adhesion requirements. Within the warranty period, remove to sound material and rework all areas unable to meet adhesion requirements. There must be zero percent sealant failures within one year. Within the warranty period, remove and rework all sealant material with chemically attacked surfaces or lifting from joint walls. Topcoat cracking over sealant is excluded from warranty.

## PART 2 PRODUCTS

### 2.1 JOINT SEALANT

Formulate the joint sealant to exhibit the properties as listed in Table Ia.

### 2.2 THIN FILM FLOORING SYSTEM

A three-coat industrial flooring system consisting of primer and two urethane topcoats. Apply the coating system at a Dry Film Thickness (DFT) ranging from 13 to 20 mils and contain a broadcast of aluminum oxide non-skid grit.

#### 2.2.1 Primer Coat

In addition to the requirements of the thin film flooring system, use MPI 211 primer coat.

#### 2.2.2 Urethane Topcoat

In addition to the requirements of the thin film flooring system, use MPI 212 top coat.



### 2.3 WHITE ALUMINUM OXIDE NON-SKID GRIT

Size No. 60, dust free (washed and dry), minimum 99 percent pure, having the following sieve analysis when tested using a 2.2 pound sample (ASTM E11):

Sieve No. 40	100 percent passing
Sieve No. 50	15-30 percent retained
Sieve No. 60	70-85 percent retained
Sieve No. 70	0-15 percent retained

## PART 3 EXECUTION

### 3.1 COATING SAMPLE COLLECTION

The Contracting Officer and QC Manager must witness all material sampling. Notify the Contracting Officer a minimum of three days in advance of sampling. Obtain liquid samples of each component of primer and topcoat by random selection from sealed containers and in accordance with ASTM D3925. Samples may be either individual cans of liquid material or 1.0 quart quantities of properly mixed, extracted, and sealed liquid material. Identify samples by designated name, specification number, batch number, project Contract number, sample date, intended use, and quantity involved. When the applied coating system has met the requirements defined in the paragraph ADHESION TESTING, return coating to the installation Contractor for proper disposal.

### [3.2 TILE AND TILE ADHESIVE REMOVAL

Remove 100 percent of tile employing one or more of the following techniques: chipping, scraping, sanding, scarification, high-pressure water, and various hand tools. Remove 100 percent of the tile adhesive using solvents and power scrubbing. Remove residual contamination using hot potable water under a minimum of 4,000 psi. Resulting surfaces must appear clean and display the gray color of concrete.

### ]3.3 JOINT MATERIAL REMOVAL, RE-SAW CUTTING, CRACK CHASING

Remove 100 percent of the existing material in all joints including material bonded to joint walls and base. Rigid material may require saw cutting equipment to remove. Joints may be widened up to 1/8 inch when re-saw cutting. Chase concrete cracks identified for repair and open to a minimum depth of 1/2 inch below crack surface resulting in crack(s) with smooth vertical walls. Cracks greater than 3/4 inch width can be repaired using either epoxy mortar or epoxy concrete.

### 3.4 DEGREASING

On both coated and uncoated concrete, degrease entire floor by scrubbing using a solution of hot potable water, 120 degrees F to 170 degrees F, and a concentrated water-based alkaline degreaser. Perform two complete degreasing cycles on the entire floor surface. Allow solution to soak into surfaces prior to scrubbing and remove using hot potable water under a minimum of 4,000 psi. Rinsing is complete when the rinse water appears clear. If the industrial detergent is not biodegradable, collect all rinse

water and dispose as hazardous waste. Squeegees and shop vacuums may be used to collect pooling rinse water. Fans may be used to aid drying of floor surfaces.

### [3.5 COATING SYSTEM REMOVAL

Remove 100 percent of the existing coating system employing one or more of the following techniques: shot blasting, chipping, scraping, sanding, scarification, high pressure water blasting, and various hand tools. Impact tools, such as scabblers, may be used to remove unsound epoxy mortar flooring systems. In general, a coating system cannot be completely removed by shot blasting and, to attain 100 percent coating removal, requires a combination of the above techniques.

### ]3.6 SURFACE PREPARATION

Shot blast entire floor to produce a level of coarseness equal to [ICRI 310.2R](#) CSP 3. Overlap each pass of shot blasting by [1/4 inches](#) to [1/2 inches](#). Add new shot to shot blasting equipment prior to blasting. Prepare surfaces inaccessible to shot blasting, base of perimeter walls and under secured equipment, using diamond disk grinding or light scarification to produce a level of coarseness equal to [ICRI 310.2R](#) CSP 2 or [ICRI 310.2R](#) CSP 4, respectively. Resulting surfaces must appear clean and contain the appropriate level of surface coarseness. If the resulting level of cleanliness cannot be determined, place numerous drops of water on surfaces that appear contaminated. If the water drops soak into concrete, the surfaces are free of hydrocarbon contamination (oils, grease, skydrol). If the water drops bead up and do not flatten out, surfaces require additional degreasing as detailed in the Article DEGREASING. Shot blasting coarse concrete or broom finished concrete can produce a level of coarseness equal to [ICRI 310.2R](#) CSP 5: employ a best-effort attempt to minimize over-shot-blasting of coarse concrete. If coarse concrete is encountered, shot blasting to a level of coarseness equal to [ICRI 310.2R](#) CSP 5 is acceptable: however, extremely coarse concrete can require resurfacing prior to the flooring system's installation. Sweep, vacuum, and run a high powered magnet over all surfaces to be coated, including joints.

### 3.7 JOINT TREATMENT

Use the "Conventional Sealed Joint" as detailed in Figure 1 of [SSPC-TU 2/NACE 6G197](#) to seal joints. Employ measures to reduce contamination from equipment and foot traffic. Limit floor access to essential Contractor personnel. Confirm joint surfaces are sufficiently clean.

#### 3.7.1 Install Backer Rod

Install a continuous length of round, closed-cell polyethylene backer rod into each joint using a backer rod tool. For [1/2 inch](#), [3/8 inch](#), and [1/4 inch](#) wide joints, place backer rod to a depth of [3/8 inch](#) (depth equals the distance from the concrete's surface to the highest point on the backer rod). For joints greater than or equal to [3/4 inch](#) width, place backer to a depth of [5/8 inch](#) below the concrete's surface. Fit backer rod tight between joint walls (30 percent compression). Remove and reinstall all backer rod that is installed using either the incorrect size (loose fit) or at the incorrect depth. Following backer rod installation, apply painter's tape to surfaces adjacent joints to protect from sealant.

#### 3.7.2 Joint Sealant Application

Apply sealant directly into joints using a bulk-caulking gun. At room temperature, the resulting sealant application must exhibit a concave recess between  $1/8$  inch to  $1/16$  inch below the concrete's surface. Remove and reapply cured sealant remaining either flush or greater. Following sealant application, remove painter's tape and sealant drips on concrete surfaces. Cure sealant a minimum of 24 hours, prior to the application of coatings.

### 3.8 PRE-APPLICATION TESTING FOR CONTAMINATION

Spot check surfaces for oil/grease contamination using the water break test. At a rate of 5 tests per 1000 square feet, place one to two drops of water onto surfaces and observe for beading. Test all other surfaces that show visible signs of potential contamination. Apply additional degreasing techniques to surfaces displaying water beading in accordance with the Article DEGREASING.

### 3.9 COATING APPLICATION

Vacuum flooring space one additional time prior to coating application.

#### 3.9.1 Primer Application

Apply MPI 211 epoxy primer to flooring space at 7.0 mils to 15.0 mils Dry Film Thickness (DFT). If the prepared concrete resembles an ICRI 310.2R CSP 3 surface, apply the primer at a minimum of 7.0 mils DFT. If the prepared concrete resembles an ICRI 310.2R CSP 5 surface, apply the primer at a maximum of 15.0 mils DFT. The previously applied sealant may be lightly coated.

#### 3.9.2 Non-Skid Grit Broadcast

Broadcast non-skid grit at a rate of 1.5 pounds per 100 square feet into the second urethane top coat and backroll. Map floor into 600 square foot sections where 9.0 pounds of non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 square foot section.

#### 3.9.3 Application of Topcoats

Apply two coats of MPI 211 epoxy urethane topcoat to the epoxy primer and broadcast white aluminum oxide non-skid grit directly into the second urethane topcoat.

##### 3.9.3.1 First Topcoat

Apply a full coat of the urethane topcoat at a spreading rate from 2.5 to 3.2 mils Dry Film Thickness (DFT). Stripe coat perimeter edges and around equipment footings. Monitor and record a minimum of one Wet Film Thickness (WFT) reading per 600 square feet of floor surface. Sealant is to be lightly coated.

##### 3.9.3.2 Second Topcoat

Apply a second coat of the urethane topcoat at a spreading rate of 2.5 to 3.2 mils DFT. Stripe coat perimeter edges and around equipment footings. Monitor and record a minimum of one WFT reading per 600 square feet of floor surface prior to broadcasting non-skid grit. When the correct WFT has been applied per 600 square feet of area, immediately and evenly

broadcast non-skid grit directly into the second topcoat of urethane and backroll in two directions. Test the adhesion of the thin film flooring system in accordance with the paragraph ADHESION TESTING.

### 3.9.3.3 Walkway Stripe and Grounding Rod Markings

Place the walkway stripe and grounding rod markings according to Government drawings, if applicable. When the second topcoat is within its recoat window, apply a walkway stripe of the red/orange urethane topcoat at 3.0 mils DFT, completely hiding the top coat, in one coat. If insufficient hiding occurs, apply one additional coat of the walkway stripe. Lightly broadcast non-skid grit into the wet walkway stripe. Use solvent-resistant tape to protect the floor coating against stripe coat bleed. A thin clear coat of either epoxy or urethane may be required to prevent stripe coat bleed prior to the full application of the colored stripe coat. Apply grounding rod markings using similar procedures, urethane top coat, and colors and size according to Government drawings.

## 3.10 CURING

Cure installed materials to display performance equal to manufacturer's product literature. Remove and reapply improperly cured material.

## 3.11 FIELD QUALITY CONTROL

### 3.11.1 Coating Inspector

Consider the Coating Inspector as a QC Specialist, who works for the QC Manager, and qualified in accordance with Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector must be present during all field tests, surface preparation, flooring application, initial cure of the flooring system, and during all flooring repair work. The Coating Inspector must provide all tools/equipment necessary to perform field tests and inspection. The Coating Inspector is responsible for field tests and specified level of inspection.

### 3.11.2 Inspection

Document weather conditions, job site occurrences, and report conditions and occurrences potentially detrimental to the flooring system. The listed inspection requirements are in addition to the QC inspection and reporting requirements defined in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector must prepare a project reference sheet outlining all requirements, tests, test methods, and evaluation criteria, and hold regular meetings with Contractor personnel, including shot blasting operators and applicators, to review requirements/evaluation criteria for upcoming work prior to execution. At the start of coating operations and every hour following until daily work is complete, record air temperature, substrate temperature, and relative humidity. Following the application of each coat, inspect surfaces for improperly cured material, blisters, inadequate or excessive coating thickness, and other defects. Document each inspection, test, non-compliant area, and location of each non-compliant area. List method of evaluation, evaluation criteria, areas requiring rework, and all other pertinent observations.

#### 3.11.2.1 Daily Inspection Report

Submit to the Contracting Officer one copy of the daily inspection report completed each day when performing work under this Section. Use Appendix

X1 "Inspection Checklist" of [ASTM D6237](#) to monitor daily activity and to assist in preparing the daily inspection report. Note each non-compliant issue and each issue identified for rework in accordance with the QC documentation procedures of Section [01 45 00.00 10 01 45 00.00 20 01 45 00.00 40](#) QUALITY CONTROL. Use of forms containing entry blocks for all required data is encouraged. The data must be legible and presented in a professional format. Submit report within 24 hours of the report date.

#### 3.11.2.2 [Inspection Logbook](#)

Maintain a continuous record of all activity related to this Section on a daily basis. A computer / software package as outlined in Table II is preferred to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information including photo documentation where appropriate. The designated Government Representative for the project is assigned the highest level Administrator privileges and only the Administrator must be able to modify reports. In areas where photography is not allowed, the computer must come with verification that the camera / photo capability has been removed.

Alternatively, a continuous record of all activity related to this Section must be maintained in an Inspection Logbook on a daily basis. The logbook must be hard or spiral bound with consecutively numbered pages, and must be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

#### 3.11.2.3 [Inspection Equipment](#)

Use equipment in good condition, operational within its design range, and calibrated as required by the specified standard for use with each device.

#### 3.11.3 [Adhesion Testing](#)

Perform a minimum of three adhesion tests in accordance with [ASTM D4541](#) to the thin film flooring system. Select three random flooring locations spaced a minimum of [20 feet](#) between each location. Prior to attaching pull-off coupons, lightly sand flooring surface and attach pull-off coupons containing a grit-blasted anchor profile. Adhere directly to the center of each sanded surface a [3/4 inch](#) diameter pull-off coupon. When pull-off coupon adhesive has sufficiently cured, score circumference of each pull-off coupon to concrete substrate. Test adhesion and evaluate results. If testing produces cohesive failures within the concrete, no less than [40 mils](#) concrete removed over 95 percent of each pull-off coupon, or adhesion more than [400 psi](#) coating system's adhesion is acceptable. If the above requirements are not satisfied, then perform one adhesion test per [100 square feet](#) using the above procedures. Perform two additional tests per non-compliant area to confirm results. Remove to sound material and rework all areas unable to meet adhesion requirements. Repair each adhesion test using a combination of primer, sand-filled epoxy mortar (for deep cohesive failures, if applicable), and two urethane topcoats. Make repairs flush with adjacent coatings and display an equivalent appearance.

### 3.12 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in

and around the work areas to their original condition.



TABLE I - MATERIALS REQUIREMENTS	
TABLE Ia	
<u>Test</u>	<u>Minimum Requirement (maximum where indicated)</u>
Sealant System (two-pack: self-leveling)	Polysulfide (Manganese Cure; MnO <sub>2</sub> ) or Urethane
Percent Volume Solids	100 percent
Chemical Resistance to JP-8 plus 100 Fuel at 70 degrees F (ASTM D1308) (see note 1)	48 hours immersion: 2.0 percent (max) weight increase, 5.0 percent (max) volume increase, 2.0 percent (max) weight loss
Chemical Resistance to Motor Oils at 70 degrees F (ASTM D1308) (see note 1)	48 hours immersion: 2.0 percent (max) weight increase, 5.0 percent (max) volume increase, 2.0 percent (max) weight loss
Chemical Resistance to Skydrols at 70 degrees F (ASTM D1308) (see note 1)	48 hours immersion: 2.0 percent (max) weight increase, 5.0 percent (max) volume increase, 2.0 percent (max) weight loss
Hardness (ASTM D2240: Shore A)	20
Tensile Strength (ASTM D412) (or ASTM D638)	150 psi
Percent Elongation (ASTM D412) (or ASTM D638)	500 percent
Tack Free at 65 degrees F (ASTM C679)	12 hours maximum
Adhesion to Concrete	140 psi
Adhesion to Urethane Topcoats (paintable sealant)	140 psi
NOTES: (1) Immerse and test a minimum of three 2 inch by 1/2 inch by 1/2 inch section of cured sealant.	



TABLE II
Reporting Program Requirements QA/QC
Administrative Controls:
Administrators must be able to turn on and off unique access to specific jobs and Contracts.
Administrators must be able to remotely enable and disable access for users.
All enabled users must view the same active report in real time. There must be no opportunity for multiple versions of the same report to exist.
Administrators must be able to setup unique approval processes for each project and promote or remove unique people from this process at any time.
Administrators must be able to associate Contract specific documents and specification limits quickly and easily.
Administrators must be able to associate PDS, SDS, blueprints, scope of work and Contracts uniquely to each job.
Objectivity Controls:
Data Entry fields must be by multi-selectable choices, numeric keypads, pickers and skip logic to ensure repeatable data entry in a way that makes running analytics and metrics easy and objective.
The program / hardware package must be able to communicate with inspection devices that provide (batch) data export capability such as Elcometer and Defelsko gages.
The program / hardware package must automatically time, date and GPS stamp all reports without input or interference from the inspector.
Real Time Syncing:
Forms must be available for approved associates to view at all times.
Retrievable storage must be provided for all job related reports and documents for a minimum time of 5 years from completion of the job or project. Archiving of the documents after 5 years will be the responsibility of the Government.
Document Library:
All reports must be in searchable and annotatable PDF format.
The Administrator must be able to upload and annotate job specific reports in real time. Examples include but not limited to Safety Data Sheets, Product Data Sheets and Blueprints.

TABLE II

Annotations and modifications must be locked and associated with the document. Only the Administrator has rights to modify or delete annotations or allow modifications to the document library especially all related inspection reports.

Customization:

The program must be capable of being customized to specific jobs, Contracts or specifications.

-- End of Section --

## SECTION 09 67 23.16

## FUEL RESISTIVE RESINOUS FLOORING, 5-COAT SYSTEM

02/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

- ASTM C679 (2015; R 2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants
- ASTM D412 (2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
- ASTM D638 (2014) Standard Test Method for Tensile Properties of Plastics
- ASTM D1308 (2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM D2240 (2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
- ASTM D3925 (2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
- ASTM D4541 (2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- ASTM D6237 (2019) Standard Guide for Painting Inspectors (Concrete and Masonry Substrates)
- ASTM E11 (2022) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

## INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

- ICRI 310.2R (2013) Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 9001 (2015) Quality Management Systems- Requirements

## MASTER PAINTERS INSTITUTE (MPI)

MPI 208	(2020) Floor Coating, Thick Film, Primer, for Aircraft Maintenance Facilities
MPI 209	(2020) Floor Coating, Thick Film, Epoxy Mortar, For Aircraft Maintenance Facilities
MPI 210	(2020) Floor Coating, Thick Film, Grout Coat, For Aircraft Maintenance Facilities
MPI 212	(2018) Floor Coating, Thin Film, for Aircraft Maintenance Facilities

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC QP 5	(2012) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QP 8	(2015) Standard Procedure for Evaluating the Qualifications of Contracting Firms that Install Polymer Coatings, Surfacing, Linings or FRP Composites on Concrete and Other Cementitious Substrates
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC-TU 2/NACE 6G197	(1997) Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1926.59	Hazard Communication

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Joint Sealant; G[, [\_\_\_\_]]

Epoxy Mortar Flooring System; G[, [\_\_\_\_]]

White Aluminum Oxide Non-Skid Grit; G[, [\_\_\_\_]]

## SD-05, Design Data

## Environmental Control System

## SD-06 Test Reports

Joint Sealant Test Report; G[, [\_\_\_\_]]

Primer Coat; G[, [\_\_\_\_]]

Epoxy Mortar Coat; G[, [\_\_\_\_]]

Grout Coat; G[, [\_\_\_\_]]

Urethane Topcoat; G[, [\_\_\_\_]]

White Aluminum Oxide Non-Skid Grit; G[, [\_\_\_\_]]

Patch Test Demonstration; G[, [\_\_\_\_]]

Daily Inspection Report; G[, [\_\_\_\_]]

Adhesion Testing; G[, [\_\_\_\_]]

## SD-07 Certificates

Coating Work Plan; G[, [\_\_\_\_]]

Qualifications of Coating Contractors; G[, [\_\_\_\_]]

Joint Sealant Certificates; G[, [\_\_\_\_]]

Epoxy Mortar Flooring System Certificates; G[, [\_\_\_\_]]

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coating Inspection Company

Qualifications of QC Specialist Coating Inspector

Warranty; G[, [\_\_\_\_]]

## SD-08 Manufacturer's Instructions

Joint Sealant Manufacturer's Instructions; G[, [\_\_\_\_]]

Epoxy Mortar Flooring System Manufacturer's Instructions; G[, [\_\_\_\_]]

Water-Based Alkaline Degreaser; G[, [\_\_\_\_]]

## SD-11 Closeout Submittals

Inspection Logbook; G[, [\_\_\_\_]]

## 1.3 QUALITY ASSURANCE

## 1.3.1 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third-party PCS. Submit documentation that the specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS must remain certified during the entire project, and the Contracting Officer must be notified of any change in certification status within 10 days of the change. The PCS must not be the designated coating inspector.

#### 1.3.2 Coating Work Plan

- a. Include coating Work Plan in Quality Control Plan.
- b. Provide procedures for reviewing Contract Documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.
- c. Provide procedures for verification of key processes during Initial Phase to ensure that Contract requirements can be met. Key processes must include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.
- d. Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of non-compliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with Contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.
- e. [Provide procedures for determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.] [\_\_\_\_\_]
- f. Provide procedures for correcting non-compliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well as to avoid delays in production. Provide procedures for repairing defects in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to correct coating thickness non-compliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.
- g. If a procedure is based on a proposed or approved request for deviation, the deviation must be referenced. Changes to procedures must be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

#### 1.3.3 Design Data

#### 1.3.3.1 Environmental Control System

Submit design details of the proposed environmental control system to include ventilation, humidity control, and temperature regulation. Provide calculations for humidity control during separate surface preparation and coating application procedures, ventilation requirements during coating application, and maximum allowable coating application rates to coincide with ventilation. Include basis of design data on local conditions. Provide equipment layout sketches and procedures showing function of each piece of equipment and fail-safe measures. A Certified Industrial Hygienist must approve calculations, work procedures and personal protective equipment.

#### 1.3.4 Test Reports

##### 1.3.4.1 Joint Sealant Test Report

Submit test results that confirm sealant complies with Table Ia requirements. Samples must have been tested within the last three years.

##### 1.3.4.2 Daily Inspection Report

Submit one copy of the daily inspection report to the Contracting Officer within 24 hours of the date recorded.

#### 1.3.5 Certificates

##### 1.3.5.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.3.5.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third-party PCS. Submit documentation that specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS must remain certified during the entire project, and the Contracting Officer must be notified of any change in certification status within 10 days of the change. The PCS must not be the designated coating inspector.

##### 1.3.5.3 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company performing all coating inspection functions is certified by SSPC to the requirements of **SSPC QP 5** prior to Contract award. The approved coating inspection company must remain and not be changed through completion of the Contract. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification

is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in coating inspection company certification status. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from SSPC and furnish a copy of all inspection reports.

#### 1.3.5.4 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to **SSPC QP 5**, Level II, by the selected coating inspection company. Each inspector must remain employed by the coating inspection company while performing any coating inspection functions. In addition to the handwritten records, the inspector must employ an electronic reporting program with functionality as outlined in Table II. The Administrator must be the designated Government Representative for the project.

#### 1.3.5.5 Qualifications of Coating Contractors

All Contractors that perform surface preparation or coating application must be certified to **SSPC QP 8** and should also be **SSPC QS 1** certified prior to Contract award and must remain certified while accomplishing any surface preparation or coating application. The painting Contractors must remain so certified for the duration of the project. If a Contractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site audits from SSPC and furnish a copy of all audit reports.

[ For OCONUS, non-US territories where documentation is provided that certified **SSPC QP 8** with or without **SSPC QS 1** Contractors did not bid and are not available, all Contractors that perform surface preparation or coating application must be certified to **ISO 9001** prior to Contract award, and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from the ISO certifying organization and furnish a copy of all inspection reports.

] [Minimum requirements for the installation Contractor are as follows:  
Completed three or more jobs within the past two years applying the specified materials to concrete surfaces in which the total area exceeds **200,000 square feet**. Submit documentation listing location of work, point of contact at job site, total square footage of applied materials, listing of both materials and equipment used, and validation from coating manufacturer documenting quality of materials purchased per job for work totaling **200,000 square feet** within the past two years. In addition to the above requirements, installation Contractor must be certified by the material manufacturer(s) to install the submitted coatings and sealant. Submit copy of certificates.

#### ] 1.3.5.6 Joint Sealant Certificates



Submit literature documenting the sealant's past performance in automotive or aircraft maintenance shops. Minimum requirements are two or more maintenance shops with joint work totaling **10,000 linear feet** whereby the sealant has performed for two years with less than one percent combined sealant failures and defects. Include from sealant manufacturer a list of shop locations, total linear feet of sealant applied per shop, shop point of contact, date sealant was applied, and the name of the installed sealant material.

#### 1.3.5.7 Epoxy Mortar Flooring System Certificates

Provide manufacturer's certification of conformance to Contract requirements.

[ Submit literature documenting the coating system's past performance in aircraft maintenance shops and over floors with high Moisture Vapor Emission (MVE) rates. Minimum requirements are two or more aircraft maintenance shops totaling **34,000 square feet** where the coating system has performed for two years with less than 0.05 percent combined premature coating failures, material defects and surface discoloration; no more than 0.03 percent discoloration from aviation chemicals, tire plasticizers, and UV exposure. Provide a minimum of two additional case histories where successful installation occurred on floor slabs with no less than **4.5 pounds moisture per 24 hours, 1000 square feet**. Include from flooring manufacturer a list of shop locations, total coated area per shop, shop point of contact, date coating system was applied, successful installation to concrete with high MVE, and the names of the installed coating materials.

#### ]1.3.6 Product Data

##### 1.3.6.1 Joint Sealant Manufacturer's Instructions

Submit manufacturer's printed instructions to include detailed application procedures, minimum and maximum application temperatures, and curing procedures. In accordance with **29 CFR 1926.59**, include Safety Data Sheets (SDS) for the sealant to be used at the job site.

##### 1.3.6.2 Epoxy Mortar Flooring System Manufacturer's Instructions

Submit manufacturer's printed instructions to include detailed mixing, minimum and maximum application temperatures, acceptable atmospheric and interior climatic conditions, application procedures, curing procedures, and procedures for flooring system maintenance cleaning. Provide explicit instructions detailing surface preparation, recoat windows and remedial actions in case recoat windows are missed, and, if applicable, solvent-wiping between coats with acceptable types and grades of solvents. In accordance with **29 CFR 1926.59**, include SDSs for the coatings to be used at the job site.

##### 1.3.6.3 Water-Based Alkaline Degreaser

Submit manufacturer's printed instructions to include detailed mixing, dilution rate, application procedures, and rinsing procedures. In accordance with **29 CFR 1926.59**, include SDSs for the water-based alkaline degreaser to be used at the job site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Store coatings and sealant in spaces with temperatures from **40 to 75**

degrees F. Inspect materials on site for damage prior to use. Return to manufacturer any packaged materials in dented, rusty, or leaking containers. Return to manufacturer materials with an expired shelf life for testing, and if compliant, reissuing of shelf life extension.

#### 1.5 COATING HAZARDS

Ensure that employees are trained in all safety plan aspects. Follow the coating manufacturer's written safety precautions throughout mixing, application, and curing of coatings. Comply with respiratory protection requirements in 29 CFR 1910.134 and safe levels of airborne contaminants in 29 CFR 1910.1000.

#### 1.6 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D4541, ASTM D6237, SSPC-TU 2/NACE 6G197, and ICRI 310.2R, including replica standards ICRI 310.2R-CSP 1 through CSP 9, at the job site.

#### 1.7 PATCH TEST DEMONSTRATION

Prior to the submitted flooring system's approval, apply the complete flooring system to a 10 foot by 10 foot square concrete section as prepared in accordance with PART 3 EXECUTION. Within this area, perform three adhesion tests using procedures as detailed in the paragraph ADHESION TESTING. If adhesion testing produces cohesive failures within the concrete, no less than 40 mils concrete removed over 95 percent of each pull-off coupon, or adhesion more than 400 psi, patch test adhesion is acceptable. If concrete surface preparation was insufficient, apply an additional coating system patch to properly prepared concrete followed by the above adhesion testing. If adhesion results are unacceptable for both the topcoat and the coatings below the grout coat, submit a new coating system manufactured by a different coating vendor. Apply new coating system to a patch and subject this patch to the above requirements for adhesion prior to approval. If customer is not satisfied with the non-skid grit application, adjustments to the specifications can be made. Grit coarser than No. 60 aluminum oxide is not recommended. Immediately following "passing" adhesion results, remove urethane topcoats and grout coat by sanding, repair patch test holes using epoxy mortar, and place a "Key-In Termination" adjacent to patch test perimeter. Perform coarse scarification or pneumatic scabbling as required to remove patch tests failing to meet adhesion requirements.

#### 1.8 WARRANTY

Warranty materials and workmanship for a minimum of one year following completion of flooring and sealant application. The following terms and conditions form a part of the warranty: If the applied coating system develops blisters (chemical), checks, softening, or lifting within one year following application, rework each area at Contractor's expense. The following conditions are excluded from the warranty: A) Concrete cracking, flooring system mirrors cracks in concrete, B) cosmetic imperfections due to scratching and gouging, C) application to metallic concrete finishes (Section 09 97 23 METALLIC TYPE CONDUCTIVE/SPARK RESISTANT CONCRETE FLOOR FINISH), and D) application to concrete with a MVE rate greater than 5.0 pounds moisture per 24 hours, 1000 square feet. If the coating system's adhesion is in question, perform one adhesion test per 100 square feet as described in the paragraph ADHESION TESTING. To satisfy the warranty, adhesion testing must produce cohesive failures within the concrete,

concrete removal over 95 percent of each pull-off coupon, or adhesion no less than 400 psi. Each area failing to meet adhesion requirements requires two additional adhesion tests to confirm results. Within the warranty period, remove to sound material and rework all areas unable to meet adhesion requirements. There must be zero percent sealant failures within one year. Within the warranty period, remove and rework all sealant material that has chemically attacked surfaces or lifting from joint walls. Topcoat cracking over sealant is excluded from warranty.

## PART 2 PRODUCTS

### 2.1 JOINT SEALANT

Formulate the joint sealant to exhibit the properties as listed in Table Ia.

### 2.2 EPOXY MORTAR FLOORING SYSTEM

A five-coat flooring system consisting of primer, epoxy mortar, grout coat, and two urethane topcoats. Apply the system at a nominal thickness of 1/4 inch and contain an aluminum oxide non-skid grit broadcast. Additional requirements for primer coat, epoxy mortar, grout coat, and urethane top coat are contained in the following sub-paragraphs.

#### 2.2.1 Primer Coat

In addition to the epoxy mortar flooring system requirements, use MPI 208 primer coat.

#### 2.2.2 Epoxy Mortar Coat

In addition to the epoxy mortar flooring system requirements, use MPI 209 epoxy mortar coat compatible with MPI 208, MPI 210, and MPI 212.

#### 2.2.3 Grout Coat

In addition to the epoxy mortar flooring system requirements, use MPI 210 grout coat compatible with MPI 208, MPI 209, and MPI 212.

#### 2.2.4 Urethane Topcoat

In addition to the epoxy mortar flooring system requirements, use MPI 212 topcoat compatible with MPI 208, MPI 209, and MPI 210.

### 2.3 WHITE ALUMINUM OXIDE NON-SKID GRIT

Size No. 60, dust-free (washed and dry), minimum 99 percent pure, having the following sieve analysis when tested using a 2.2 pound sample (ASTM E11):

Sieve No. 40	100 percent passing
Sieve No. 50	15-30 percent retained
Sieve No. 60	70-85 percent retained
Sieve No. 70	0-15 percent retained

## PART 3 EXECUTION

### 3.1 COATING SAMPLE COLLECTION

The Contracting Officer and QC Manager must witness all material sampling. Notify the Contracting Officer a minimum of three days in advance of sampling. Obtain liquid samples of each component (e.g., primer, intermediate, grout coat, topcoat) by random selection from sealed containers and in accordance with [ASTM D3925](#). Samples may be either individual cans of liquid material or 1.0 quart quantities of properly mixed, extracted, and sealed liquid material. Label samples by designated name, specification number, batch number, project Contract number, sample date, intended use, and quantity involved. When the applied epoxy mortar system has met the requirements defined in the paragraph ADHESION TESTING, return coating samples to the installation contractor for proper disposal.

### [3.2 TILE AND TILE ADHESIVE REMOVAL

Remove 100 percent of tile employing one or more of the following techniques: chipping, scraping, sanding, scarification, high-pressure water, and various hand tools. Remove 100 percent of the tile adhesive using solvents and power scrubbing. Remove residual contamination using hot potable water under a minimum of 4,000 psi. Resulting surfaces must appear clean and display the gray color of concrete.

### ]3.3 JOINT MATERIAL REMOVAL, RE-SAW CUTTING, CRACK CHASING

Remove 100 percent of the existing material in all joints including material bonded to joint walls and base. Rigid material may require saw cutting equipment to remove. Joints may be widened up to 1/8 inch when re-saw cutting. Hairline cracks having no more than 1/8 inch width are typically not repaired. Cracks greater than 1/8 inch width can be chased to a minimum depth of 1/2 inch and sealed using the procedures and materials specified for joints. Cracks more than 3/4 inch width can be repaired using either epoxy mortar or epoxy concrete. Chase concrete cracks identified for repair and open to a minimum depth of 1/2 inch below crack surface resulting in crack(s) with smooth vertical walls.

### 3.4 DEGREASING

On both previously coated and uncoated concrete, degrease entire floor by scrubbing using a hot potable water solution, 120 to 170 degrees F, and a concentrated water-based alkaline degreaser. Perform two complete degreasing cycles on the entire floor surface. Allow solution to soak into surfaces prior to scrubbing and remove using hot potable water under a minimum of 4,000 psi. Rinsing must be complete when the rinse water appears clear. If the industrial detergent is not biodegradable, collect all rinse water and dispose of as hazardous waste. Squeegees and shop vacuums may be used to collect pooling rinse water. Fans may be used to aid drying of floor surfaces.

### [3.5 COATING SYSTEM REMOVAL

Remove 100 percent of the existing coating system employing one or more of the following techniques: shot blasting, chipping, scraping, sanding, scarification, high pressure water blasting, and various hand tools. Impact tools such as scabblers may be used to remove unsound epoxy mortar flooring systems. In general, a coating system cannot be completely removed by shot blasting and, to attain 100 percent coating removal, requires a combination of the above techniques.

### ]3.6 SURFACE PREPARATION

Shot blast entire floor to produce a level of coarseness equal to [ICRI 310.2R](#) CSP 3. Overlap each shot blasting pass by  $1/4$  to  $1/2$  inch. Add new shot to shot blasting equipment prior to blasting. Prepare concrete surfaces inaccessible to shot blasting, perimeter wall bases and under secured equipment, using a diamond disk grinding or light scarification to produce a level of coarseness equal to [ICRI 310.2R](#) CSP 2, [ICRI 310.2R](#) CSP 4, respectively. Resulting surfaces must appear clean and contain the appropriate surface coarseness level. If the resulting cleanliness level cannot be determined, place numerous drops of water on surfaces that appear contaminated. If the water drops soak into concrete, the surfaces are hydrocarbon contamination free (oils, grease, skydrol). If the water drops bead up and do not flatten out, surfaces require additional degreasing as detailed in the Article DEGREASING. Shot blasting coarse concrete or broom finished concrete can produce a coarseness level equal to [ICRI 310.2R](#) CSP 5: employ a best-effort attempt to minimize over-shot-blasting of coarse concrete. If coarse concrete is encountered, shot blasting to a level of coarseness equal to [ICRI 310.2R](#) CSP 5 is acceptable: however, extremely coarse concrete can require resurfacing prior to the flooring system's installation. Sweep, vacuum, and run a high powered magnet over all surfaces to be coated, including joints.

#### 3.6.1 Concrete Masonry Units (CMU) Surface Preparation

Remove 100 percent of coatings  $4$  inches up the base of CMU walls adjacent the flooring space, and prepare surface by power grinding to a resulting level of coarseness equal to [ICRI 310.2R](#) CSP 2. If oils/grease are present, degrease in accordance with the Article DEGREASING.

### 3.7 COVE STRIP INSTALLATION

Install a continuous cove strip at a nominal height of  $4$  inches up each CMU perimeter wall base. Install a solvent-resistant cove strip using a solvent-resistant adhesive.

### 3.8 KEY-IN TERMINATIONS

Place the "Key-In" termination as detailed in [SSPC-TU 2/NACE 6G197](#) Figure 8 at transition surfaces, directly below doorways, and adjacent walls, floor drains, drain grates (interior side), and all other obstructions embedded into the floor slab. The Key-In termination must contain one vertical wall at a depth from  $3/8$  to  $5/8$  inch and, leading down to the resulting vertical depth, a sloped surface from  $1-1/2$  to  $2$  inches. A hand held concrete saw can be used to cut the correct vertical depth followed by power tool grinding to create a sloped surface. Remove concrete dust by vacuuming.

### 3.9 CRACK REPAIRS

Use the "Elastomeric Underlayer Crack-Bridging Design" as detailed in [SSPC-TU 2/NACE 6G197](#) Figure 7 over the surface of epoxy mortar filled cracks.

#### 3.9.1 Install Bondbreaker

Install bondbreaker, either solvent-resistant bondbreaker tape or a  $1/8$  to  $1/4$  inch No. 20-No. 40 mesh silica sand layer, to the base of previously chased cracks identified for repair. For cracks without a rigid base,

install suitably sized fiberboard to a depth of 1/2 inch below floor level and with bondbreaker over exposed fiberboard. Install bondbreaker to cover the crack's horizontal base and continuously span the entire crack length. Bondbreaker application prevents epoxy mortar from penetrating deep into cracks. Use bondbreaker tape no more than 6 mils thick. In this application, the use of backer rod is prohibited.

### 3.9.2 Repair Cracks

Using the specified materials, prime interior crack walls and apply epoxy mortar directly into wet primer. Finish epoxy mortar level with floor and without feathered edges. When cured, remove mortar imperfections by sanding flush with adjacent concrete. Apply solvent-resistant tape parallel to each side of the mortar filled crack(s) at a minimum inner width of 4 inches between tape. A 4 inch inner tape width is generally suitable for cracks less than 1/2 inch wide whereas cracks more than 1/2 inch wide can require an inner tape width of 6 inches. Apply 1/24 inch of the specified sealant, in one coat, directly over filled crack(s) and spread flush with inner tape edges: a stiff bristled paintbrush can be used to spread the sealant. Use a Wet Film Thickness (WFT) gage to confirm sealant application is between 35 to 40 mils wet. Remove tape and allow sealant to cure a minimum of 24 hours prior to the epoxy mortar flooring system application. Sealant application above 50 mils dry will require removal and reapplication.

### 3.10 PRE-APPLICATION TESTING FOR CONTAMINATION

Spot check surfaces for oil/grease contamination using the water break test. At a rate of 5 tests per 1000 square feet place one to two water drops onto surfaces and observe for beading. Test all other surfaces that show visible signs of potential contamination. Perform additional degreasing to surfaces displaying water beading in accordance with Article DEGREASING.

### 3.11 COATING APPLICATION

Prior to the flooring system application, vacuum flooring space and mark all joints.

#### 3.11.1 Isolation (Expansion) and Construction Joint Treatment

Install into each isolation (expansion) and construction joint, a continuous length of round polyethylene backer rod flush with the floor's surface and under 30 percent compression.

#### 3.11.2 Contraction Joint Treatment

Apply primer and epoxy mortar directly into all contraction joints. This quantity is in addition to the specified 1/4 inch epoxy mortar thickness. This step may be performed either prior to, or during, the full epoxy mortar application.

#### 3.11.3 Primer Application

Apply MPI 208 epoxy primer to flooring space at a minimum of 10.0 mils wet. Do not prime previously installed patch test.

#### 3.11.4 Epoxy Mortar Application

Apply MPI 209 epoxy mortar at 1/4 inch directly into wet primer using a screed box or equal equipment. Finish open areas using a power trowel with stainless steel blades. Perimeter edges and adjacent equipment footings may require finishing by stainless steel hand trowel. Directly above areas with Key-In terminations and at a distance from 1 to 1-1/2 inches away from the mortar's outer edge, slope the mortar down and flush with the concrete's surface. Terminate the resulting angle flush with the Key-In termination vertical cut. Apply epoxy mortar flush with previously installed patch test. Do not apply epoxy mortar onto patch test surface. When sufficiently cured, sand entire mortar surface. Resulting surface must appear level, contain uniform thickness, and be free of surface imperfections including trowel marks.

### 3.11.5 Primer Application to CMU Walls

When the epoxy mortar has sufficiently cured, prime approximately 4 inches up base of CMU walls to cove strip and 2 inches adjacent the wall's base using the specified primer.

### 3.11.6 Epoxy Mortar Application to CMU Walls

Apply MPI 209 epoxy mortar directly into wet primer at 3/16 to 1/4 inch. Use a cove trowel to create a rounded transition between floor surfaces and perimeter wall bases. When sufficiently cured, sand the base and 4 inches up perimeter walls. Resulting finish must contain a rounded transition of uniform thickness between flooring surfaces and CMU walls. When sufficiently cured, sand mortar surfaces. Resulting surface must be free of surface imperfections including trowel marks.

### 3.11.7 Grout Coat Application

Sweep and vacuum up residual dust from epoxy mortar sanding. Apply MPI 210 grout coat to epoxy mortar at a minimum of 10 mils wet. Apply grout coat to previously install patch test. Where wall bases are used, extend coating up CMU wall. If the cured grout coat feels oily/greasy, an amine blush has occurred which requires removal. Consult the coating manufacturer to recommend an appropriate blush removal procedure. Epoxy amines can blush during cool temperatures with high humidity.

### 3.11.8 Grout Coat Sanding

Sand grout coat using 100 grit or finer sandpaper to a dull appearance with visible scratches. Resulting surface must appear 100 percent absent of gloss with zero shiny spots. Lightly sand perimeter edges and around equipment footings.

### 3.11.9 Saw Cutting and Sealing Joints

Use the "Conventional Sealed Joint" as detailed in Figure 1 of SSPC-TU 2/NACE 6G197 to seal each contraction and expansion joint. Take care to reduce contamination from saw cutting equipment and foot traffic. Limit floor access to essential Contractor personnel. When performing joint work, including saw cutting, suggest placing clean rolled cardboard adjacent joint surfaces to reduce coating system contamination.

#### 3.11.9.1 Saw Cut Contraction Joints

Place saw cuts directly in the middle of each contraction joint 1/4 inch wide, placed to a minimum depth of 1-1/4 inches, and span the joint's

entire length.

#### 3.11.9.2 Saw Cut Isolation (Expansion) and Construction Joints

Place saw cuts to the isolation (expansion) and construction joint's original width and to a minimum depth of 1-1/4 inches. Completely remove the epoxy mortar across the joint's width and further remove the previously installed backer rod.

#### 3.11.9.3 Install Backer Rod

Install a continuous length of round, closed-cell polyethylene backer rod into each saw cut. For 1/2, 3/8 and 1/4 inch wide saw cuts, place backer rod to a depth of 3/8 inch below the grout coat's surface the highest point on the backer rod. For expansion joint saw cuts greater than or equal to 3/4 inch wide, place backer rod to a depth of 5/8 inch below the grout coat's surface. Fit backer rod tight between joint walls under 30 percent compression and place using a backer rod tool. Remove and reinstall all backer rod that is the incorrect size or at the incorrect depth. Following backer rod installation, apply painter's tape to surfaces adjacent joints to protect from sealant.

#### 3.11.9.4 Joint Sealant Application

Apply sealant directly into joints using a bulk-caulking gun. At room temperature, the resulting sealant application must exhibit a concave recess between 1/8 to 1/24 inch below the grout coat's surface. Remove and reapply cured sealant remaining either flush or greater. Following sealant application, remove painter's tape and sealant drips on grout coat. Prior to topcoating, cure sealant a minimum of 24 hours.

#### 3.11.10 Application of Topcoats

Apply two coats of MPI 212 urethane topcoat. Broadcast No. 60, white, aluminum oxide non-skid grit into the second urethane topcoat.

##### 3.11.10.1 Non-Skid Grit Broadcast

Broadcast non-skid grit at a rate of 1.0 pound per 100 square feet into the second urethane topcoat and backroll. Map floor into 600 square foot sections where 9.0 pounds of non-skid grit is pre-weighed, placed into clean buckets and used in its entirety per marked 600 square foot section.

##### 3.11.10.2 Grout Coat Cleaning

Inspect floor for shiny grease spots and, if detected, spot degrease using manufacturer approved solvent(s) with clean, lint-free rags. Sweep and vacuum up all residual dirt and dust. Solvent wipe all surfaces using solvent(s) and procedures as recommended by manufacturer of epoxy mortar flooring system.

##### 3.11.10.3 First Topcoat

Apply a full coat of urethane topcoat at a spreading rate from 2.5 to 3.2 mils Dry Film Thickness (DFT). Stripe coat perimeter edges and around equipment footings. Monitor and record a minimum of one Wet Film Thickness (WFT) reading per 600 square foot section of floor surface. Sealant is to be lightly coated.



#### 3.11.10.4 Second Topcoat

Apply a second coat of urethane topcoat at a spreading rate from 2.5 to 3.2 mils DFT. Stripe coat perimeter edges and around equipment footings. Monitor and record a minimum of one WFT reading per 600 square foot section of floor surface prior to broadcasting non-skid grit. When the correct WFT has been applied per 600 square feet of area, immediately and evenly broadcast non-skid grit into the second urethane topcoat and backroll in two directions. Test the adhesion of the epoxy mortar flooring system in accordance with the paragraph ADHESION TESTING.

#### 3.11.10.5 Walkway Stripes and Grounding Rod Markings

Place the walkway stripe and grounding rod marker, if applicable, according to Government drawings. When the second topcoat is within its recoat window, apply a walkway stripe of the red/orange urethane topcoat at 3.0 mils DFT. Lightly broadcast non-skid grit into the wet walkway stripe. Use solvent-resistant tape to protect the floor coating against stripe coat bleed. A thin clear coat of either epoxy or urethane may be required to prevent stripe coat bleed prior to the full application of the colored stripe coat. Completely hide the topcoat color with the red/orange stripe, in one coat. If insufficient hiding occurs, apply one additional walkway stripe coat. Apply grounding rod markings using similar procedures, urethane topcoat, and colors and size according to Government drawings.

### 3.12 CURING

Installed materials must cure and display performance equal to manufacturer's product literature. Remove and reapply improperly cured material.

### 3.13 FIELD QUALITY CONTROL

#### 3.13.1 Coating Inspector

Consider the Coating Inspector a QC Specialist, working for the QC Manager, and be qualified in accordance with Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector must be present during all field tests, surface preparation, flooring application, initial cure of the flooring system, and during all flooring repair work. The Coating Inspector must provide all tools/equipment necessary to perform field tests and inspection. The Coating Inspector is responsible for field tests and specified level of inspection.

#### 3.13.2 Inspection

Document weather conditions, job site occurrences, and report conditions and occurrences potentially detrimental to the flooring system. The listed inspection requirements are in addition to the QC inspection and reporting requirements defined in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector must prepare a project reference sheet outlining all requirements, tests, test methods, and evaluation criteria, and hold regular meetings with Contractor personnel, including shot blasting operators and applicators, to review requirements/evaluation criteria for upcoming work prior to execution. At the start of coating operations and every hour following until daily work is complete, record air temperature, substrate temperature, and relative humidity. Following each coat application, inspect surfaces for improperly cured material, blisters, inadequate or excessive coating thickness, and other defects.

Document each inspection, test, non-compliant area, and location of each non-compliant area. List evaluation method, evaluation criteria, areas requiring rework, and all other pertinent observations.

#### 3.13.2.1 Daily Inspection Report

Submit to the Contracting Officer one copy of the daily inspection report completed each day when performing work under this Section. Use Appendix X1 "Inspection Checklist" of [ASTM D6237](#) to monitor daily activity and to assist in preparing the daily inspection report. Note each non-compliant issue and each issue identified for rework in accordance with the QC documentation procedures in Section [01 45 00.00 10 01 45 00.00 20 01 45 00.00 40](#) QUALITY CONTROL. Use of forms containing entry blocks for all required data is encouraged. The data must be legible and presented in a professional format. Submit report within 24 hours of the report date.

#### 3.13.2.2 Inspection Logbook

Maintain a continuous record of all activity related to this Section on a daily basis. A computer / software package as outlined in Table II is preferred to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information including photo documentation where appropriate. The designated Government Representative for the project is assigned the highest level Administrator privileges and only the Administrator must be able to modify reports. In areas where photography is not allowed the computer must come with verification that the camera / photo capability has been removed.

Alternatively, a continuous record of all activity related to this Section must be maintained in an Inspection Logbook on a daily basis. The logbook must be hard or spiral bound with consecutively numbered pages, and must be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. Submit the original Inspection Logbook to the Contracting Officer upon completion of the of the project and prior to final payment.

#### 3.13.2.3 Inspection Equipment

Use equipment in good condition, operational within its design range, and calibrated as required by the specified standard for each device.

#### 3.13.3 Adhesion Testing

Perform a minimum of three modified adhesion tests ([ASTM D4541](#)) on the topcoat no less than forty-eight hours following application. Select three random flooring locations spaced a minimum of [20 feet](#) between each location. Vertically core completely through the epoxy mortar flooring system and a minimum of [3/8 inch](#) into concrete using a suitable drill fitted with a [1 inch](#) diameter core bit. Throughout coring, employ a best effort attempt to avoid fracturing and overheating both the mortar system and concrete: improper coring can affect adhesion results. Adhere directly to each cored surface's center a [3/4 inch](#) diameter pull-off coupon. Lightly sand test area flooring surface prior to attaching pull-off coupons containing a grit-blasted anchor profile. When pull-off coupon adhesive has sufficiently cured, test adhesion and evaluate results. If testing produces cohesive failures within the concrete, no less than [40 mils](#) concrete removed over 95 percent of each pull-off coupon, or adhesion more than [400 psi](#) mortar system's adhesion is acceptable. If the above requirements are not satisfied, then perform one adhesion test per [100](#)

square feet using the above procedures. Two additional tests will confirm results for each non-compliant area. Remove and rework all areas unable to meet adhesion requirements to sound material. Fill core holes using primer, sand-filled epoxy mortar, grout coat, and urethane topcoats. Finish resulting repairs flush with adjacent coatings, displaying an equivalent appearance.

#### 3.14 FINAL CLEANUP

Following work completion, remove debris, equipment, and materials from site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.



TABLE I	
MATERIAL REQUIREMENTS	
<u>Table Ia - Sealant</u>	
<u>Test</u>	<u>Minimum Requirement (maximum where indicated)</u>
Sealant System (two-pack: self-leveling)	Polysulfide (Manganese Cure; MnO <sub>2</sub> ) or Urethane
Percent Volume Solids	100 percent
Chemical Resistance to JP-8 plus 100 Fuel at 70 degrees F (ASTM D1308) (see note 1)	48 hours immersion: 2.0 percent (max) weight increase, 5.0 percent (max) volume increase, 2.0 percent (max) weight loss
Chemical Resistance to Motor Oils at 70 degrees F (ASTM D1308) (see note 1)	48 hours immersion: 2.0 percent (max) weight increase, 5.0 percent (max) volume increase, 2.0 percent (max) weight loss
Chemical Resistance to Skydrols at 70 degrees F (ASTM D1308) (see note 1)	48 hours immersion: 2.0 percent (max) weight increase, 5.0 percent (max) volume increase, 2.0 percent (max) weight loss
Hardness (ASTM D2240: Shore A)	20
Tensile Strength (ASTM D412) (or ASTM D638)	150 psi
Percent Elongation (ASTM D412) (or ASTM D638)	500 percent
Tack Free at 65 degrees F (ASTM C679)	12 hours maximum
Adhesion to Sand Filled Epoxy Polyamine	140 psi
Adhesion to Urethane Topcoats (paintable sealant)	140 psi
NOTES: (1) Immerse and test a minimum three - 2 by 1/2 by 1/2 inch section of cured sealant.	

TABLE II
Reporting Program Requirements QA/QC
Administrative Controls:
Administrators must be able to turn on and off unique access to specific jobs and Contracts.
Administrators must be able to remotely enable and disable access for users.
All enabled users must view the same active report in real time. There must be no opportunity for multiple versions of the same report to exist.
Administrators must be able to setup unique approval processes for each project and promote or remove unique people from this process at any time.
Administrators must be able to associate Contract specific documents and specification limits quickly and easily.
Administrators must be able to associate PDS, SDS, blueprints, scope of work and Contracts uniquely to each job.
Objectivity Controls:
Data Entry fields must be by multi-selectable choices, numeric keypads, pickers and skip logic to ensure repeatable data entry in a way that makes running analytics and metrics easy and objective.
The program / hardware package must be able to communicate with inspection devices that provide (batch) data export capability such as Elcometer and Defelsko gages.
The program / hardware package must automatically time, date and GPS stamp all reports without input or interference from the inspector.
Real Time Syncing:
Forms must be available for approved associates to view at all times.
Retrievable storage must be provided for all job related reports and documents for a minimum time of 5 years from completion of the job or project. Archiving of the documents after 5 years will be the responsibility of the Government.
Document Library:
All reports must be in searchable and annotatable PDF format.
The Administrator must be able to upload and annotate job specific reports in real time. Examples include but not limited to Safety Data Sheets, Product Data Sheets and Blueprints.

TABLE II

Annotations and modifications must be locked and associated with the document. Only the Administrator has rights to modify or delete annotations or allow modifications to the document library especially all related inspection reports.

Customization:

The program must be capable of being customized to specific jobs, Contracts or specifications.

-- End of Section --

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## SECTION 09 68 00

## CARPETING

11/17, CHG 2: 08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(2004; E 2008; E 2010) Colorfastness to Light
AATCC 107	(2013) Colorfastness to Water
AATCC 134	(2016) Electrostatic Propensity of Carpets
AATCC 165	(2013) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
AATCC 174	(2016) Antimicrobial Activity Assessment of New Carpets

## ASTM INTERNATIONAL (ASTM)

ASTM D297	(2015; R 2019) Rubber Products - Chemical Analysis
ASTM D1335	(2017; E 2018) Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2859	(2016) Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
ASTM D3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D3574	(2017) Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams
ASTM D3676	(2013) Rubber Cellular Cushion Used for Carpet or Rug Underlay
ASTM D5793	(2018) Standard Test Method for Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings

ASTM D5848	(2020) Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM D6859	(2011) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
ASTM D7330	(2015) Standard Test Method for Assessment of Surface Appearance Change in Pile Floor Coverings Using Standard Reference Scales
ASTM E648	(2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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## CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2015) Carpet Installation Standard for Commercial Carpet
CRI 105	(2015) Carpet Installation Standard for Residential Carpet
CRI GLP QM	(2017) Green Label Plus Quality Manual
CRI Test Method 103	(2015) Standard Test Method for the Evaluation of Texture Appearance Retention of Carpet Standards Program

## GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use
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## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551	(2020) Textile Floor Coverings and Textile Floor Coverings in Tile Form- Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions and Distortion Out of Plane
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## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113	(2016) Architectural Coatings
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1630 Standard for the Surface Flammability of  
Carpets and Rugs (FF 1-70)

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

WOOLMARK COMPANY (WBI)

Woolmark (1964) Certification for 100 Percent Pure  
New Woo

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Installation Drawings; G[, [\_\_\_\_\_]]

### SD-03 Product Data

Carpet; G[, [\_\_\_\_\_]]

Carpet Cushion; G[, [\_\_\_\_\_]]

Recycled Content for Carpeting; S

Recycled Content for Fiber Cushion; S

Recycled Content for Rubber Cushion; S

Recycled Content for Polyurethane-Foam Cushion; S

Moldings; G[, [\_\_\_\_\_]]

Indoor Air Quality for Aerosol Adhesives; S

Indoor Air Quality for Non-Aerosol Adhesives; S

Indoor Air Quality for Concrete Primer; S

### SD-04 Samples

Carpet; G[, [\_\_\_\_\_]]

Moldings; G[, [\_\_\_\_\_]]

Carpet Cushion; G[, [\_\_\_\_\_]]

### SD-06 Test Reports

Moisture and Alkalinity Tests; G[, [\_\_\_\_]]

#### SD-07 Certificates

Indoor Air Quality for Carpet; S

Indoor Air Quality for Fiber Cushion; S

Indoor Air Quality for Rubber Cushion; S

Indoor Air Quality for Polyurethane-Foam Cushion; S

#### SD-08 Manufacturer's Instructions

Surface Preparation

#### SD-10 Operation and Maintenance Data

Cleaning and Protection

Maintenance Service

#### SD-11 Closeout Submittals

Warranty

### 1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

##### 1.3.1.1 Floor Covering Materials

Provide carpet and cushion products certified to meet indoor air quality requirements by **UL 2818** (GreenGuard) Gold, **SCS** Global Services Indoor Advantage Gold, **CRI GLP QM** or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Do not store carpet or carpet tiles with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants, including paints and adhesives. Do not store carpet near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

### 1.5 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above

60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract.

#### 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten year wear warranty, two year material and workmanship and ten year tuft bind and delamination.

### PART 2 PRODUCTS

#### 2.1 CARPET

Furnish first quality carpet that is free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Submit manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's Product Data for 1) Carpet, 2) Moldings, and 3) Carpet Cushion. Also, submit Samples of the following:

- a. Carpet: [Two] [\_\_\_\_\_] "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified
- b. Moldings: [Two] [\_\_\_\_\_] samples of each type minimum 12 inches long
- c. Carpet Cushion: [Two] [\_\_\_\_\_] samples minimum 6 by 6 inches

##### 2.1.1 Recycled Content

Carpeting must contain a minimum of [20] [40] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for carpeting.

##### 2.1.2 Indoor Air Quality Requirements

Products must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for carpet.

##### 2.1.3 Physical Characteristics for [Broadloom] [Modular Tile] [Entrance] Carpet

###### 2.1.3.1 Carpet Construction

[Tufted] [Woven] [Bonded] [Needlebond] [Needle Felt] [\_\_\_\_\_]

###### 2.1.3.2 Type

[Broadloom [12] [6] feet minimum usable carpet width [with exception of corridors] [and] [stairs] [\_\_\_\_\_].] [Modular tile [18 by 18] [20 by 20] [24 by 24] [36 by 12] [48 by 12] [\_\_\_\_\_] inch square with 0.15 percent growth/shrink rate in accordance with ISO 2551.] [Entrance [18 by 18]

[\_\_\_\_\_] inch square [12] [6] feet width [\_\_\_\_\_] mat size.] [See Section [09 69 13 RIGID GRID ACCESS FLOORING] [ and ] [09 69 19 STRINGERLESS ACCESS FLOORING] for size required for a one to one alignment with raised access floor panels.]

#### 2.1.3.3 Pile Type

[Level-loop] [Multilevel loop] [Cut and loop] [Frieze] [Cut pile] [Random sheared] [Level tip shear]

#### 2.1.3.4 Pile Fiber

Commercial 100 percent branded (federally registered trademark) [nylon continuous filament] [nylon staple] [wool with Woolmark certification] [wool blend with Wool Bureau certification] [\_\_\_\_\_].

#### 2.1.3.5 Gauge or Pitch

Minimum [\_\_\_\_\_] inch in accordance with ASTM D5793

#### 2.1.3.6 Stitches or Rows/Wires

Minimum [\_\_\_\_\_] per square inch

#### 2.1.3.7 Surface Pile Weight

Minimum [\_\_\_\_\_] ounces per square yard. This does not include weight of backings. Determine weight in accordance with ASTM D5848.

#### 2.1.3.8 Pile Thickness

Minimum [\_\_\_\_\_] inch in accordance with ASTM D6859

#### 2.1.3.9 Pile Density

Minimum [\_\_\_\_\_]

#### 2.1.3.10 Dye Method

[Solution dyed] [Stock dyed] [Yarn (or Skein) dyed] [Piece dyed] [Space dyed] [Continuous dyed]

#### 2.1.3.11 Backing Materials

Provide primary backing materials like [those customarily used and accepted by the trade for each type of carpet] [polypropylene] [synthetic material] [rubber] [jute] [cotton] [\_\_\_\_\_]. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet.

#### 2.1.3.12 Attached Cushion

Provide an attached cushion [chemically frothed polyurethane with minimum weight of 18 oz/sq. yard, minimum density of 11 lb/cubic foot] [mechanically frothed polyurethane with minimum weight of 22 oz/sq. yard, minimum density of 14 lb/cubic foot, minimum thickness of 0.100 inch, and maximum compression resistance of 5 psi, and compression set of 15 percent in accordance with ASTM D3676]. Do not exceed the maximum ash content of 50 percent when tested in accordance with ASTM D297. Pass the accelerated

aging test in accordance with [ASTM D3676] [ASTM D1667] for the cushion.

## 2.2 PERFORMANCE REQUIREMENTS

### 2.2.1 Texture Appearance Retention Rating (TARR)

Provide carpet with a greater than or equal to [3.0 (Heavy)] [3.5 (Severe)] TARR traffic level classification in accordance with ASTM D7330 or CRI Test Method 103.

### 2.2.2 Static Control

Provide static control to permanently regulate static buildup to less than [3.5] [2.0] [\_\_\_\_\_] kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC 134.

### 2.2.3 Flammability and Critical Radiant Flux Requirements

Comply with 16 CFR 1630 or ASTM D2859. Provide carpet in corridors and exits with a minimum average critical radiant flux of [0.22] [0.45] watts per square centimeter when tested in accordance with ASTM E648.

### 2.2.4 Tuft Bind

Comply with ASTM D1335 for tuft bind force required to pull a tuft or loop free from carpet backing with a minimum [10 pound average force for loop pile broadloom] [3 pound average force for cut pile broadloom] [8 pound average force for modular carpet tile].

### 2.2.5 Colorfastness to Crocking

Comply dry and wet crocking with AATCC 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

### 2.2.6 Colorfastness to Light

Comply colorfastness to light with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

### 2.2.7 Colorfastness to Water

Comply colorfastness to water with AATCC 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

### 2.2.8 Delamination Strength

Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

### 2.2.9 Antimicrobial

Nontoxic antimicrobial treatment in accordance with AATCC 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

## 2.3 CARPET CUSHION

### [2.3.1 Fiber Cushion

[Rubberized hair, mothproofed and sterilized] [Rubberized jute [with minimum 40 percent recycled content], mothproofed and sterilized] [Synthetic with minimum [\_\_\_\_] percent recycled content] [Resinated, recycled textile]. [Provide data identifying percentage of [recycled content for fiber cushion](#).]

Products must meet emissions requirements of [CDPH SECTION 01350](#). Provide certification or validation of [indoor air quality for fiber cushion](#).]

2.3.1.1 Weight

[\_\_\_\_] oz./sq. yd.

2.3.1.2 Thickness

[\_\_\_\_] inches plus 5 percent maximum

2.3.1.3 Density

[\_\_\_\_] lb/cu.ft.

] [2.3.2 Rubber Cushion

[Flat] [Rippled waffle] [Textured flat] [Reinforced] [, with minimum 60 percent recycled content. Provide data identifying percentage of [recycled content for rubber cushion](#).]

Products must meet emissions requirements of [CDPH SECTION 01350](#). Provide certification or validation of [indoor air quality for rubber cushion](#).]

2.3.2.1 Weight

[\_\_\_\_] oz./sq. yd.

2.3.2.2 Thickness

[\_\_\_\_] inches plus 5 percent maximum

2.3.2.3 Compression Resistance

[\_\_\_\_] kg/sq. mm [\_\_\_\_] lb/sq. in. at [25] [65] percent in accordance with [ASTM D3574](#).

2.3.2.4 Density

[\_\_\_\_] lb/cu.ft.

] [2.3.3 Polyurethane-Foam Cushion

[Grafted prime] [Densified] [Bonded] [Mechanically frothed] [, with minimum 15 percent recycled content. Provide data identifying percentage of [recycled content for polyurethane-foam cushion](#).]

Products must meet emissions requirements of [CDPH SECTION 01350](#). Provide certification or validation of [indoor air quality for polyurethane-foam cushion](#).]

2.3.3.1 Compression Force Deflection at 65 Percent



[\_\_\_\_\_] lb/sq.in. of polymer density in accordance with [ASTM D3574](#)

#### 2.3.3.2 Thickness

[\_\_\_\_\_] inches plus 5 percent maximum

#### 2.3.3.3 Density

[\_\_\_\_\_] kg/cu.m [\_\_\_\_\_] lb/cu.ft.

#### 2.3.4 Performance Requirements - Critical Radiant Flux

Provide carpet cushion in corridors and exits with a minimum average critical radiant flux of [0.22] [0.45] watts per square centimeter when tested in accordance with [ASTM E648](#).

### 2.4 ADHESIVES AND CONCRETE PRIMER

Comply with applicable regulations regarding toxic and hazardous materials. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with [ASTM D3278](#).

Non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). Provide validation of indoor air quality for aerosol adhesives. Provide validation of indoor air quality for non-aerosol adhesives. Concrete primer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of indoor air quality for concrete primer.

### 2.5 MOLDINGS

Provide carpet moldings where floor covering material changes or carpet edge does not abut a vertical surface. Provide [a heavy-duty [vinyl] [rubber] molding designed for the type of carpet being installed. Provide floor flange of a minimum [1 1/2 inches] wide. Provide [\_\_\_\_\_] color to match [resilient base] [\_\_\_\_\_] .] [an aluminum molding, pinless clamp-down type, designed for the type of carpet being installed. Provide [natural color anodized] [prefinished color [\_\_\_\_\_] finish. Provide a floor flange of a minimum 1-1/2 inch wide and face a minimum 5/8 inch wide.]]

### 2.6 TAPE

Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in broadloom installation. Seam sealant must have a maximum VOC content of no more than 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

## 2.7 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with [Section 09 06 00 SCHEDULES FOR FINISHES] [the drawings] [\_\_\_\_\_].

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit [three] [\_\_\_\_\_] copies of the manufacturer's printed Installation instructions for the carpet, including Surface Preparation, seaming techniques, and recommended adhesives and tapes.

### 3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content and excessive alkalinity in accordance with CRI 104/CRI 105. Submit [three] [\_\_\_\_\_] copies of reports of Moisture and Alkalinity Tests including content of concrete slab stating date of test, person conducting the test, and the area tested.

### 3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with the carpet manufacturer's instructions. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

### 3.4 INSTALLATION

Isolate area of installation from rest of building. Perform all work by manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI 104/CRI 105. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet. Submit [three] [\_\_\_\_\_] copies of Installation Drawings for 1) Carpet, 2) Carpet Cushion, and 3) Moldings indicating areas receiving carpet, carpet types, patterns, direction of pile, location of seams, and locations of edge molding.

Do not install building construction materials that show visual evidence of biological growth.

#### 3.4.1 Broadloom Installation

Install broadloom carpet [direct glue down] [pre-applied adhesive glue down] smooth, uniform, and secure, with a minimum of seams. Apply regular, unnoticeable, and treated seams with a seam adhesive. Run side seams toward the light, where practical, and where such layout does not increase the number of seams. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit cutouts, at door jambs, columns and ducts securely. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points. Provide seams at changes in directions of corridors to follow the wall line parallel to the carpet direction. Lay the carpet lengthwise down the corridors with widths less than 6 feet.

#### 3.4.2 Modular Tile Installation

Install modular tiles with [releasable] [manufacturer approved adhesive tab system] [permanent vinyl-compatible] [\_\_\_\_\_] adhesive and snug joints. Use [monolithic] [1/4 turn] [ashlar] [brick] [herringbone] [random] [\_\_\_\_\_] installation method. Comply with manufacturer installation instructions for required drying time of releasable adhesive so it sets up properly. Provide accessibility to the subfloor where required. Carpet tile on stairs and sloped surfaces must be installed with a more permanent installation method in accordance with the manufacturer's instructions and with manufacturer recommended adhesives for this application. [See Section [09 69 13 RIGID GRID ACCESS FLOORING] [ and ] [09 69 19 STRINGERLESS ACCESS FLOORING] for installation method of carpet tile on access flooring.]

#### 3.4.3 Entrance Carpet Installation

[Install tiles with [permanent vinyl-compatible] [releasable] adhesive and snug joints. Use [monolithic] [1/4 turn] [ashlar] [brick] [random] installation method.] [Install roll goods [direct glue down] [pre-applied adhesive glue down] and smooth, uniform, and secure, with a minimum of seams. Prepare regular, unnoticeable, and treated seams with a seam adhesive. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit, securely, cutouts at door jambs, columns, and ducts. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points.] [Cut mats to specified size and finish them with a tapered vinyl edge that is glued and sewn on.]

#### [3.4.4 Stretch-in Installation

Provide carpet tack strips wherever carpeting abuts vertical surfaces. Install tackless carpet stripping by nailing. Place carpet cushion face-up, as recommended by cushion manufacturer, over entire floor area to be carpeted with joints butted. Do not use adhesives to attach carpet, cushion, or substrate. Comply with carpet manufacturer's instructions for installation. Attach rubber or metal edge strip to substrate with adhesive for transition when carpet meets other flooring materials or to finish carpet edge when required.

### ] 3.5 CLEANING AND PROTECTION

Submit [three] [\_\_\_\_\_] copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

#### 3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

### 3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover. Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer.

### 3.6 REMNANTS

Manage waste as specified in the Waste Management Plan. [Provide remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total [to the Government] [to local non-profit such as Habitat for Humanity as directed by the Government]]. [Set aside and return non-retained scraps to manufacturer for recycling into new product] [Remove non-retained scraps from site and recycle appropriately].

### 3.7 MAINTENANCE

#### 3.7.1 Extra Materials

Provide extra material from same dye lot consisting of [full width continuous broadloom] [and] [uncut carpet tiles] for future maintenance. Provide a minimum of [three] [\_\_\_\_\_] percent of total square yards of each carpet type, pattern, and color. [Furnish [three] [\_\_\_\_\_] percent extra of total adhesive tabs.]

#### 3.7.2 Maintenance Service

Collect information from the manufacturer about [maintenance agreement] [green lease] options, and submit to Contracting Officer. Service must reclaim materials for recycling and/or reuse. Service must not landfill or burn reclaimed materials. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation of manufacturer's [maintenance agreement] [take-back program] [green lease] for carpet. Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and reuse.

-- End of Section --

## SECTION 09 69 13

## RIGID GRID ACCESS FLOORING

11/15, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30 (2016) Engineered Wood Construction Guide

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

## ASTM INTERNATIONAL (ASTM)

ASTM A780/A780M (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM B85/B85M (2018) Standard Specification for Aluminum-Alloy Die Castings

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E648 (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F150 (2006; R 2013) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

ASTM F1700 (2020) Standard Specification for Solid Vinyl Floor Tile

ASTM F1861 (2021) Standard Specification for Resilient Wall Base

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor

## Sources using Environmental Chambers

## CEILINGS AND INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)

**CISCA Access Floors** (2007) Recommended Test Procedures for Access Floors

## COMPOSITE PANEL ASSOCIATION (CPA)

**CPA A208.1** (2016) Particleboard

**CPA A208.2** (2016) Medium Density Fiberboard (MDF) for Interior Applications

## GREEN SEAL (GS)

**GS-36** (2013) Adhesives for Commercial Use

## ICC EVALUATION SERVICE, INC. (ICC-ES)

**ICC-ES AC300** (2014) Acceptance Criteria for Access Floors

## INTERNATIONAL CODE COUNCIL (ICC)

**ICC IBC** (2018) International Building Code

## MASTER PAINTERS INSTITUTE (MPI)

**MPI 58** (2012) Stain for Concrete Floors

**MPI 99** (2012) Sealer, Water Based, for Concrete Floors

**MPI 104** (2012) Sealer, Solvent Based, for Concrete Floors

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

**ANSI/NEMA LD 3** (2005) Standard for High-Pressure Decorative Laminates

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 75** (2020) Standard for the Protection of Information Technology Equipment

**NFPA 99** (2021; TIA 20-1) Health Care Facilities Code

**NFPA 253** (2011) Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

**SCAQMD Rule 1113** (2016) Architectural Coatings

**SCAQMD Rule 1168** (2017) Adhesive and Sealant Applications

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-C-490 (Rev H; 2021) Chemical Conversion Coatings and Pretreatments for Metallic Substrates (Base for Organic Coatings)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Detailed Installation Drawings; G[, [\_\_\_\_]]

Fabrication Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

Access Flooring System; G[, [\_\_\_\_]]

Recycled Content of Access Flooring System; S

Indoor Air Quality For Pedestal Adhesive; S

Indoor Air Quality For Concrete Sealer; S

Indoor Air Quality For Adhesives; S

### SD-04 Samples

Floor Panels

Floor Covering; G[, [\_\_\_\_]]

Panel Support System

Accessories; G[, [\_\_\_\_]]

Fascia; G[, [\_\_\_\_]]

Exposed Step and Ramp Structure; G[, [\_\_\_\_]]

Railings; G[, [\_\_\_\_\_]]

Perforated Directional Air Supply Panels; G[, [\_\_\_\_\_]]

Cut Outs; G[, [\_\_\_\_\_]]

#### SD-05 Design Data

Seismic Calculations

#### SD-06 Test Reports

Factory Tests

Concentrated Load

Uniform Live Load

Rolling Load

Impact Load

Ultimate Load

Stringer Load

Pedestal Axial Load

Bonding Strength of Pedestal Adhesive

Electrical Resistance

Field Tests

#### SD-07 Certificates

Compliance with ICC-ES AC308

Compliance with ICC IBC

Certificate of Compliance

Qualification of Manufacturer

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Lifting Device

Warranty[; G, [\_\_\_\_\_]]



### 1.3 SPARE PARTS

[Furnish spare floor panels for each finish including bare panels for carpet tile, complete pedestal assemblies, and stringers at the rate of one for each 100 or fraction thereof required.][ Provide [four] [\_\_\_\_\_] floor panels complete with specified floor covering for future use.][ Provide four spare panels with identical floor covering pedestals and stringers for each 1,000 square feet of access flooring and total of 10 linear feet of cut-out trim. Store extra stock in same manner and location as project materials.][ Provide extra carpet tile from same dye lot consisting of uncut tiles for future maintenance. Provide a minimum of [three] [\_\_\_\_\_] percent of total square yards of each carpet type, pattern, and color. [Furnish [[five] [\_\_\_\_\_] percent extra of total adhesive tabs] [[one] [\_\_\_\_\_] percent extra of total components] required for installing carpet tile.]]

### 1.4 QUALITY CONTROL

#### 1.4.1 Qualification of Manufacturer

Access flooring manufacturer must have at least 5 years experience in manufacturing access flooring systems. Certify that the manufacturer of the access flooring system meets requirements specified under paragraph entitled QUALIFICATION OF MANUFACTURER.

### 1.5 DELIVERY, STORAGE, AND HANDLING

#### 1.5.1 Delivery

Deliver materials to site in undamaged condition, in original containers or packages, complete with accessories and instructions. Label packages with manufacturer's name and brand designations. Package materials covered by specific references bearing specification number, type and class as applicable.

#### 1.5.2 Storage

Store all materials in original protective packaging in a safe, dry, and clean location. Store panels at temperatures between 40 and 90 degrees F, and between 20 and 70 percent humidity. Replace defective or damaged materials.

#### 1.5.3 Handling

Handle and protect materials in a manner to prevent damage during the entire construction period.

### 1.6 WARRANTY

Minimum manufacturer warranty must have no dollar limit, cover full system, and must have a minimum duration of [1] [5] [\_\_\_\_\_] years. Include an agreement to repair or replace floor panels, pedestals or stringers that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of panels or support system. [ For [high pressure laminate] [conductive high pressure laminate] [solid vinyl tile] [luxury vinyl tile] provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period for finish materials.][ For [conductive] [static-dissipative] vinyl tile provide

manufacturer's standard performance guarantees or warranties that extend beyond one year, standard warranty must not be less than a five year wear warranty and ten year conductivity warranty.][ For carpet tile provide manufacturer's standard performance guarantees or warranties including a minimum two years for material and workmanship and ten years for wear, static control, tuft bind and delamination.]

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- a. Provide for self-alignment of floor panels, adjustable pedestals and readily removable floor panels covered as specified.
- b. Lateral stability of floor support system must be independent of panels. Provide a finished assembly that is rigid and free of vibration, noises, and rocking panels.[ Provide bolted stringer system with equipotential plane grounding.]
- c. Submit [certificate of compliance](#) attesting that the installed access floor system meets specification requirements, including all special equipment loads and specific electrical and or cable requirements for the complete access flooring system including, but not limited to the following:
  - (1) [Compliance with ICC-ES AC300](#) and [Compliance with ICC IBC](#) Acceptance Criteria for Access Floors.
  - (2) Load-bearing capabilities of pedestals, floor panels, and pedestal adhesive resisting force.
  - (3) Supporting independent laboratory test reports. For panel, stringer and pedestal load test results include concentrated loads at center of panel, panel edge midpoint, ultimate loads and uniform loads.
  - (4) Floor electrical characteristics.
  - (5) Material requirements.
  - (6) An elevated floor system free of defects in materials, fabrication, finish, and installation, that will remain so for a period of not less than [\_\_\_\_\_] [1] years after completion.
- d. Submit manufacturer's product data for [access flooring system](#) consisting of descriptive data, catalog cuts, and installation instructions. Include in the data information about any design and production techniques, total system including all accessories and finish coatings of under-floor components, procedures and policies used to conserve energy, reduce material, improve waste management or incorporate green building/recycled products into the manufacturer of their components or products. Include cleaning and maintenance instructions. Systems which contain zinc electroplated anti-corrosion coatings are prohibited.

#### 2.1.1 Design Requirements

Conduct floor panel testing in accordance with [CISCA Access Floors](#). When tested as specified, make all deflection and deformation measurements at the point of load application on the top surface of the panel. Floor

panels must be capable of supporting the following loads:

- a. **Concentrated load** of [1000] [1250] [1500] [2000] [2500] [\_\_\_\_\_] pounds on one square inch, at any point on panel, without a top-surface deflection more than 0.10 inch, and a permanent set not to exceed 0.01 inch in any of the specified tests. Testing must be in accordance with **CISCA Access Floors**, Section 1 Concentrated Loads with test panels being supported by understructure to be used with installed system instead of steel support blocks.
- b. **Uniform live load** of [250] [300] [350] [400] [500] [\_\_\_\_\_] psf, without a top-surface deflection more than 0.06 inch, and a permanent set not to exceed 0.01 inch in any of the specified tests, when tested in accordance with **CISCA Access Floors**, Section 7 Uniform Load Test with test panels being supported by understructure to be used with installed system instead of steel support blocks.
- c. A **rolling load** of [600] [800] [1000] [1200] [1600] [\_\_\_\_\_] pounds applied through hard rubber surfaced wheel 6 inch diameter by 2 inch wide for 10,000 cycles over the same path. Permanent set at conclusion of test must not exceed 0.040 inch when tested in accordance with **CISCA Access Floors**, Section 3 Rolling Loads.
- d. A **rolling load** of [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds applied through a 3 inch diameter by 1-13/16 inch wide caster for 10 cycles over the same path, without developing a local overall surface deformation greater than 0.04 inch. In accordance with **CISCA Access Floors**, Section 3 Rolling Loads, the permanent deformation limit under rolling load must be satisfied in all of the specified tests.
- e. An **impact load** of [150] pounds anywhere on the panel dropped from a height of 36 inches onto a 1 square inch area without failure of the system, according to **CISCA Access Floors**, Section 8 Drop Impact Load Test.
- f. **Ultimate Load**. Panels must meet manufactures published Ultimate Load rating of [1400] [1800] [2500] [2800] [3100] [\_\_\_\_\_] pounds when tested in accordance with **CISCA Access Floors**, Section 2 Ultimate Loading.
- g. **Safety Factor**. Panels must provide a minimum Safety Factor of 5 times the uniform load specified above in accordance with **ICC-ES AC300**.
- h. **Recycled Content**. Provide Access Flooring System (panels, stringers and pedestals) containing a minimum of [20] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of **recycled content of access flooring system**.

#### 2.1.2 Allowable Tolerances

##### 2.1.2.1 Floor Panel Flatness

Plus or minus 0.035 inches on diagonal on top of panel or underneath edge.

##### 2.1.2.2 Floor Panel Length

Plus or minus 0.015 inch.

### 2.1.2.3 Floor Panel Squareness

Plus or minus 0.02 inch in panel length.

### 2.1.3 Stringers

Provide stringers capable of supporting a [\_\_\_\_\_] pound [ 250 pound] [ 200 pounds] [ 350 pound] [ 450 pound] concentrated load at midspan without permanent deformation in excess of 0.010 inch, when tested in accordance with CISCA Access Floors, Section 4 Stringer Load Testing.

### 2.1.4 Pedestals

Pedestals must be capable of supporting a 5000 pound axial load without permanent deformation, when tested in accordance with CISCA Access Floors, Section 5 Pedestal Axial Load Test.

### 2.1.5 Bonding Strength of Pedestal Adhesive

Adhesive for anchoring pedestal bases must have a bonding strength capable of resisting an overturning moment of [ 1,000 lbf-in] [ 2,000 lbf-in] [\_\_\_\_\_] when a force is applied to the top of the pedestal in any direction, when tested in accordance with CISCA Access Floors, Section 6 Pedestal Overturning Moment Test. Pedestal adhesive must meet emissions requirement of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type). Provide validation of indoor air quality for pedestal adhesive.

### 2.1.6 Bond Strength of Factory Installed Covering

Bond strength of floor covering must be sufficient to permit handling of the panels by use of the panel lifting device, and to withstand moving caster loads up to [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds, without separation of the covering from the panel.

### 2.1.7 Seismic Calculations

#### 2.1.7.1 Navy Project Specific Requirements

Submit seismic calculations for lateral bracing, sealed by a Professional Engineer. Document that access flooring system complies with seismic requirements of ICC IBC and ASCE 7-16 for Occupancy Importance Factor (Ip) of [1.0] [1.5], and seismic horizontal force (Fp) determined in accordance with UFC 3-301-01 and Section 1615 of the ICC IBC and ASCE 7-16, Minimum Design Loads for buildings and other structures.

#### 2.1.7.2 Army Project Specific Requirements

Submit seismic calculations for special bracing to resist the effects of seismic or other forces [in accordance with UFC 3-301-01, ICC IBC and ASCE 7-16] [as shown on the approved detailed installation drawings]. Submit design calculations which demonstrate that the proposed floor system meets requirements for seismic loading. Certified copies of test reports may be submitted in lieu of calculations.

## 2.2 FLOOR PANELS

### 2.2.1 Floor System Drawings And Planer Quality

- a. Submit [Fabrication Drawings](#) for elevated floor systems consisting of fabrication and assembly details to be performed in the factory.
- b. Indicate on Location Drawings exact location of pedestals, ventilation openings, cable cutouts, and the panel installation pattern.
- c. Provide Detail Drawings showing details of the pedestals, pedestal-floor interlocks, floor panels, panel edging, floor openings, floor opening edging, floor registers, floor grilles, cable cutout treatment, perimeter base, expansion, and peripheral support facilities.
- d. Design and workmanship of the floor, as installed, must be completely planar within plus or minus [0.060 inch in 10 feet](#), [0.100 inch](#) for the entire floor, and [0.030 inch](#) across panel joints.
- e. Floor-panel joint-width tolerances must not exceed [0.017 inch](#) as measured with a feeler gage at any point in any joint when the panels are installed and as long as the air leakage requirements specified in this section are met.
- f. Submit [three][\_\_\_\_\_] complete samples of floor panels.

#### 2.2.2 Detailed Installation Drawings

Submit [Detailed Installation Drawings](#) that as a minimum indicate the following:

- a. Location of panels
- b. Layout of supports, panels, and cutout locations
- c. Stair, handrail, and ramp framing
- d. Sizes and details of components
- e. Details at floor perimeter and height above structural floor
- f. Method of anchorage to structural subfloor
- g. Lateral bracing
- h. Typical cutout details
- i. Gasketing, return air grilles, supply air registers, and perforated panels. Include air transfer capacity of grilles, registers and panels
- j. Description of [shop] [factory] coating
- k. Floor finishes
- l. Location of connection to building grounding electrode

#### 2.2.3 Panel Construction

- a. Base access floor system on a [24 by 24 inch](#) square module providing minimum of [6] [12] [\_\_\_\_\_] [inch](#) clearance between structural floor and underside of panel and stringer. Fabricate so accurate job cutting and fitting may be done using standard sizes for perimeters and around columns.

- b. Do not expose metal on finished top surface of panels. Provide cutouts and cutout closures to accommodate utility systems and equipment intercabling. Reinforce cutouts to meet design load requirements. Provide extra support pedestals at each corner of cutout for cutout panels that do not meet specified design load requirements.
- c. Panel design must provide for convenient panel removal for underfloor servicing and for openings for new equipment. Use panels of uniform dimensions within specified tolerances. Permanently mark panels to indicate load rating and model number.
- d. Machine square floor panels to within plus or minus 0.015 inch with edge straightness plus or minus 0.0025 inch. If plastic edging is applied to the panel, the tolerances apply to the panel before the plastic edging is applied.
- [ e. Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk corrosion resistant screws with heads that are flush with top of panel.]

#### [2.2.3.1 Aluminum

Provide aluminum panels of die-cast or extruded construction conforming to [ASTM B85/B85M](#).

#### ] [2.2.3.2 Hollow Formed Steel

Steel panels must be of die-formed construction, consisting of a flat steel top sheet welded to one or more formed steel stiffener sheets or components. Panels must be chemically cleaned, bonderized, and painted with the manufacturer's standard finish.

#### ] [2.2.3.3 Cementitious-Filled Formed Steel (Composite Panels)

- a. Provide composite panels of die-formed steel construction totally enclosing the panel, including the top surface. The void spaces between the top sheet and the formed steel bottom sheet must be completely filled with an incombustible cementitious or concrete material. Seal cut edges in accordance with manufacturer's recommendations. Gravity held panels with bolted stringer understructure: Fasten end of each stringer and mid-point of each 4 foot stringer positively to pedestal heads, using manufacturer's standard screws. Provide screws that are removable from top.
- b. Grid supported panels must be further tested by supporting them at two opposite edges and applying a 500-pound load at the center of a panel selected; the panel must be similarly tested while supported at the other two edges. Weld failure at any point under this loading is not acceptable. This additional test must be applied to one panel per 500 square feet of floor in the system, but in no case less than two panels. When any weld fails, the number of panels designated by the Contracting Officer must be similarly tested; replace those panels that have a weld failure at no cost to the Government.

#### ] [2.2.3.4 Metal-Clad Wood Core

Provide wood core panels with cores of wood particleboard conforming to [CPA A208.1](#), Grade 1-M-3, or of plywood conforming to [CPA A208.2](#), [APA E30](#),

and [APA L870](#), EXT-DFPA-C-C. The core must be not less than 1 inch thick, and be faced on all sides with structurally bonded zinc-coated steel sheets not lighter than 24 gauge. All edges and corners must be sealed with zinc-coated steel or extruded aluminum. The completed panels must have a flame spread rating of 25 or less when tested in accordance with [ASTM E84](#). Provide zinc-coated steel, extruded aluminum, fire resistant vinyl, or other fire resistant edging to protect shop and field edge cuts and cutouts through the face of panels in a manner to meet specified flame spread, smoke developed and Class A fire rating requirements.

] [2.2.3.5 Lightweight Concrete Filled Panels (Exposed Concrete)

Provide lightweight concrete of lightweight structural concrete with either structural reinforcing or a die-formed, hot dipped galvanized steel bottom pan. All concrete surfaces, including those resulting from field cuts, must be sealed with the manufacturer's standard sealer before covering the surfaces with other materials. Concrete sealer must meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for concrete sealer](#).

] 2.2.4 Floor Covering

Surface floor panels with [factory applied finish materials firmly bonded in place with waterproof adhesive] [carpet tile installed in the field]. Provide finish flooring materials in corridors and exits with a critical radiant flux of not less than [0.45 watts per square centimeter (Class 1)] [0.22 watts per square centimeter (Class 2)] when tested in accordance with [ASTM E648](#) or [NFPA 253](#). The electrical resistance must remain stable over the life expectancy of the floor covering. Any anti-static agent used in the manufacturing process must be an integral part of the material, not surface applied. Bolt heads or similar attachments must not rise above the traffic surface. Submit [three] [\_\_\_\_\_] separate samples of each specified floor covering finish and color.

[2.2.4.1 High Pressure Laminate

Provide factory applied high pressure laminate surfacing conforming to [ANSI/NEMA LD 3](#), High-Wear type, Grade [HDM, 1/16 inch thickness] [\_\_\_\_\_] . Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material] [ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC] [ or ] [ABS] [\_\_\_\_\_] ]. The total system electrical resistance from the wearing surface of the floor to the ground connection must be between 1,000,000 ( $1.0 \times 10^6$ ) ohms and 20,000,000,000 ohms ( $2.0 \times 10^{10}$ ).

] [2.2.4.2 Conductive High Pressure Laminate

Provide factory applied high pressure laminate surfacing conforming to [ANSI/NEMA LD 3](#), High-Wear type, Grade [HDM, 1/16 inch thickness] [\_\_\_\_\_] . Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material] [ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC] [ or ] [ABS] [\_\_\_\_\_] ]. The total system electrical resistance from the wearing surface of the floor to the ground connection must be between 25,000 ohms ( $2.5 \times 10^4$ ) and 1,000,000 ohms ( $1.0 \times 10^6$ ).

## ][2.2.4.3 Solid Vinyl Tile

Provide factory applied conductive vinyl tile that is a homogeneous vinyl product and conforms to [ASTM F1700](#), Class I monolithic (minimum wear layer thickness [0.125 inch](#) and minimum overall thickness [0.125 inch](#)), Type A smooth surface. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ] [ABS][\_\_\_\_\_]].

## ][2.2.4.4 Luxury Vinyl Tile

Provide factory applied luxury vinyl tile conforming to Class III printed film minimum wear layer thickness of [0.020 inch](#) and minimum overall thickness [0.125 inch](#), Type [A (smooth)][ B (embossed)]. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ] [ABS][\_\_\_\_\_]].

## ][2.2.4.5 Conductive Vinyl Tile

Provide factory applied conductive vinyl tile that is a homogeneous vinyl product and conforms to [ASTM F1700](#), Class I monolithic, Type A smooth surface. Provide electrical resistance from surface to surface and surface to ground between 25,000 ohms ( $2.5 \times 10^4$ ) and 1,000,000 ohms ( $1.0 \times 10^6$ ) when tested in accordance with [ASTM F150](#). Material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ] [ABS][\_\_\_\_\_]].

## ][2.2.4.6 Static-Dissipative Vinyl Tile

Provide factory applied static-dissipative vinyl tile that is a homogeneous vinyl product and conforms to [ASTM F1700](#), Class I monolithic, Type A smooth surface. Provide electrical resistance from surface to surface and surface to ground between 1,000,000 ohms ( $1.0 \times 10^6$ ) and 1,000,000,000 ohms ( $1.0 \times 10^9$ ) when tested in accordance with [ASTM F150](#). Material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ] [ABS][\_\_\_\_\_]].

## ][2.2.4.7 Carpet Tile

Reference Section [\[09 68 00 CARPETING\]](#) [ and ] [\[09 62 38 STATIC-CONTROL FLOORING \(static-control carpet tile\)\]](#) for carpet tile specification requirements including recycled content, volatile organic compound (VOC) limits, and additional flammability testing requirements for carpet tile. Carpet tile must be field installed and comply with the following:

- a. Installation method on level surfaces must allow carpet tile to be easily removed and replaced in the field and must be installed in accordance with manufacturer's recommended installation instructions.
- b. Install carpet tile in a [monolithic][1/4



turn] [ashlar] [brick] [random] [\_\_\_\_] pattern.

- [ c. Install carpet tile on secure and level surfaces offset from the access floor grid with a [manufacturer approved odor-free adhesive tab system] [ or ] [with full spread releasable adhesive using manufacturer recommended adhesives. Comply with manufacturer installation instructions for required drying time so the adhesive sets up properly].
- ] [d. Install carpet tile on secure and level surfaces with the access flooring manufacturer's recommended installation method and components for a one to one alignment with floor panels (one carpet tile to one floor panel); equal to Tate PosiTile[, \_\_\_\_\_] or Haworth CarpetLok. This installation method requires the removal of only one carpet tile to access one raised access panel. Carpet tile size for a one-to-one installation must be slightly smaller than a standard 24 inch by 24 inch tile, coordinate required size with the raised access flooring manufacturer. Factory applied carpet tile with perimeter edge strip and field applied one to one carpet tile installation over raised access floor panels with permanent or releasable adhesive are not acceptable installation methods.
- ] [e. Carpet tile on access flooring stairs and sloped surfaces must be installed with a more permanent installation method in accordance with manufacturer's instructions and with manufacturer recommended adhesives for these types of locations.

#### ]] [2.2.4.8 Lightweight Concrete Filled (Exposed Concrete)

Provide lightweight concrete filled panel with a [MPI 58 concrete stain] [ and ] [[MPI 104 concrete floor sealer] [ or ] [MPI 99 water based concrete floor sealer]]. Apply coatings in accordance with manufacturer's instructions.

#### ] 2.2.5 Accessories

Provide the manufacturer's standard registers, grilles, perforated panels, and plenum dividers type where indicated. Provide registers, grilles, and perforated panels designed to support the same static loads as floor panels without structural failure, and capable of delivering the air volumes indicated. Registers and perforated panels must be 25 percent open area and equipped with adjustable dampers. Submit [three] [\_\_\_\_] samples and colors of each accessory.

#### 2.2.6 Resilient Base

Conform to ASTM F1861, [[Type TS (vulcanized thermoset rubber)] [or] [Type TP (thermoplastic rubber)]] [, or] [Type TV (thermoplastic vinyl)], [Style A (straight - installed with carpet)] [and] [Style B (coved - installed with resilient flooring)]. Provide [4] [6] inch high and a minimum 1/8 inch thick wall base. Provide [preformed] [job formed] corners in matching height, shape, and color.

#### 2.2.7 Adhesives

Provide adhesives as recommended by the manufacturer. Provide non-aerosol adhesive products that meet either emissions requirements of CDPH SECTION 01350 (use the requirements for either office or classroom, regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives that meet either emissions requirements of

CDPH SECTION 01350 (use the requirements for office or classroom, regardless of space type) or VOC content requirements of GS-36. Provide validation of indoor air quality for adhesives. [ Provide conductive adhesive as recommended by the manufacturer of the static-control flooring. ] [ Provide conductive releasable adhesive as recommended by the manufacturer for static-control carpet tile. ]

#### 2.2.8 Lifting Device

At turn over provide one floor panel lifting device standard with the floor manufacturer, for each individual floor area (room or corridor). Furnish a minimum of two devices. [ For AIR FORCE projects, at turnover, provide a total of two suction-type floor panel lifting devices for each floor area (room or corridor). ]

### 2.3 PANEL SUPPORT SYSTEM

Design support system to allow for 360 degree clearance in laying out cable and cutouts for service to machines and so that panel and stringer together take up maximum of 2 inches. Submit one sample of suspension system proposed for use.

#### 2.3.1 Pedestals

Provide pedestals made of steel or aluminum or a combination thereof. Ferrous materials must have a factory-applied corrosion-resistant finish. Provide pedestal base plates with a minimum of 16 square inches of bearing surface and a minimum of 1/8 inch thickness. Pedestal shafts must be threaded to permit height adjustment within a range of approximately 2 inches, to permit overall floor adjustment within plus or minus 0.10 inch of the required elevation, and to permit leveling of the finished floor surface within 0.062 inch in 10 feet in all directions. Provide locking devices to positively lock the final pedestal vertical adjustments in place. Pedestal caps must interlock with [panels] [stringers] to preclude tilting or rocking of the panels.

#### 2.3.2 Stringers

Provide stringers of rolled steel or extruded aluminum, to interlock with the pedestal heads to prevent lateral movement. Provide stringers that can be added or removed after floor is in place.

#### 2.3.3 Gaskets

Provide continuous gasketing at contact surfaces between panel and stringers to deaden sound and seal off the underfloor cavity from above for air tightness, and to maintain panel alignment.

### 2.4 FASCIA

Provide aluminum or steel fascia plates at open ends of floor, at sides of ramps and steps, and elsewhere as required to enclose the free area under the raised floor. Steel plates must have a factory applied baked enamel finish. Finish on aluminum plates must be standard with the floor system manufacturer. Fascia plates must be reinforced on the back, and supported using the manufacturer's standard lateral bracing at maximum 4 feet on center. Provide trim, angles, and fasteners as required. Submit [three] [ ] color samples for fascia.

## 2.5 STEPS AND RAMPS

Securely fasten steps and ramps to the [access flooring system](#) and to the structural floor. Include in the construction standard floor system components and custom components as required, and all supports, fasteners, and trim necessary for a finished installation. Step nosings, threshold strips, and floor bevel strips must be cast or extruded aluminum with non-slip traffic surfaces. Submit [three] [\_\_\_\_\_] color samples for [exposed step and ramp structure](#).

### 2.5.1 Steps

Height of risers must comply with applicable codes. Design steps to support a uniform load of [150 psf](#). Surface treads with the manufacturer's standard non-slip floor finish. Floor covering must be [\_\_\_\_\_] .

### 2.5.2 Ramps

Slope of ramps must comply with applicable codes and [36 CFR 1191](#) Americans with Disabilities Act (ADA). Design ramps to support the same loads as specified for floor panels. Surface ramps with the manufacturer's standard non-slip floor finish. Floor covering must be [\_\_\_\_\_] .

## 2.6 RAILINGS

Provide railings compliant with applicable codes and [36 CFR 1191](#) Americans with Disabilities Act (ADA). As a minimum railings must be of the double rail and post type, fabricated of at least [ [1 inch](#) ] [\_\_\_\_\_] [round] [square] seamless [aluminum tubing] [\_\_\_\_\_] with a [satin natural anodized] [\_\_\_\_\_] finish. At steps and ramps, make the top rail a minimum of [36 inches](#) high and parallel to the incline. Make the top rail [42 inches](#) high at open ends of the floor. Guardrails must have intermediate rails or an ornamental pattern such that a sphere [4 inches](#) in diameter cannot pass through. Space posts maximum of [4] [5] [6] feet oc. Provide railings complete with anchorages, floor plates, and end caps. [ Electronically ground hand rails to raised floor system to prevent static build-up.] Submit [three] [\_\_\_\_\_] color samples for [railings](#).

## 2.7 FACTORY TESTS

Factory test access flooring, using an independent laboratory, at the same position and maximum design elevation and in the same arrangement as shown on the drawings for installation so as to duplicate service conditions as much as possible.

### 2.7.1 Load Tests

Conduct floor panel, stringer, and pedestal testing in accordance with [CISCA Access Floors](#) to determine deformation and permanent set of panels and sytem due to concentrated, Uniform, rolling, impact and ultimate loading when panels are supported by actual understructure.

### 2.7.2 Bond Strength of Covering

Conduct test for bond strength of covering in accordance with [CISCA Access Floors](#) for rolling loads, except as specified. Panels must be tested with specified hard surface flooring and on the pedestals and stringers as specified for the installed floor. Brace the supports as necessary to prevent sideways movement during the test. Impose a test load

of [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds on the test assembly through a 3 inches in diameter and 1 inch wide hard plastic caster. Roll the caster completely across the center of the panel. The panel must withstand 20 passes of the caster with no delamination or separation of the covering.

#### [2.8 REGISTERS AND GRILLES

Registers and grilles must be [\_\_\_\_\_] inches by [\_\_\_\_\_] inches long with a minimum free area of [\_\_\_\_\_] square inches, made from extruded [aluminum] [\_\_\_\_\_] , in [mill] [\_\_\_\_\_] finish, to sustain point loads of 250 pounds per vane without failure or permanent deformation. No part of a grille may project more than 1/8 inch above the floor. Registers and grills are not permitted in a laminate floor tile system.

#### ] [2.9 PERFORATED AIR SUPPLY PANELS

Provide air supply floor panels that meet the design criteria specified for standard panels, are fabricated of 14-gage perforated steel sheet welded to minimum 16-gage side channels, are covered with high pressure laminate to match standard panels, and have a uniform perforated pattern to allow even air distribution.

#### ] [2.10 PERFORATED DIRECTIONAL AIR SUPPLY PANELS

Provide directional air supply floor panels that meet or exceed the design criteria specified for standard panels, are fabricated of [light weight die cast aluminum with powder coat finish] [welded steel vanes with powder coat finish] [perforated steel sheet welded to a formed steel pan with powder coat finish]. Submit [three] [\_\_\_\_\_] color samples for perforated directional air supply panels.

#### ] [2.11 CUT OUTS

Provide cable cutouts finished with rigid polyvinylchloride or molded polypropylene edging to conform to the appearance level of the floor surface and to cover raw edges of the cutout panel. Extrusion must be of a configuration to permit its effective and convenient use when new cable openings are required. Provide at least 24 feet of additional extrusion for future use. Submit [three] [\_\_\_\_\_] color samples for cut outs.

- a. Provide non-metallic adapter for openings less than 4 inches wide. Secure adapter adhesively in cutout to preclude removal from panel. Provide at least two adapters per 1000 square feet for future use.
- b. Openings larger than 4 inches wide must use rigid polyvinylchloride or molded polypropylene edging. Perform cutting of panels, including cutouts, outside of the building.
- c. When size of cutout reduces the performance requirement of panel, provide intermediate stringers adjacent to cutouts.

#### ] [2.12 EDGE CLOSURE

Provide 1/16 inch aluminum closure plate and extruded aluminum nosing at exposed edge of floor. Back up the closure plates with aluminum or steel framing braced diagonally, or anchor at bottom to continuous angle.

#### ] 2.13 COLOR

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated] [\_\_\_\_\_]. Color listed is not intended to limit the selection of equal colors from other manufacturers.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install access flooring at the location and elevation and in the arrangement shown on the approved detailed installation drawings. The floor system must be of the rigid grid stringer type, complete with all supplemental items, and be the standard product of a manufacturer specializing in access flooring systems.

Install the floor system in accordance with the manufacturer's instructions. Open ends of the floor, where the floor system does not abut wall or other construction, must have positive anchorage and rigid support. Maintain areas to receive access flooring between [60] [40] and 90 degrees F, and between 20 and 70 percent humidity for 24 hours prior to and during installation.

#### 3.1.1 Preparation for Installation

Clear out all debris in the area in which the floor system is to be installed. Thoroughly clean structural floor surfaces and remove all dust. Install floor coatings, required for dust or vapor control, prior to installation of pedestals, only if the pedestal adhesive will not damage the coating. If the coating and adhesive are not compatible, apply the coating after the pedestals have been installed and the adhesive has cured.

#### 3.1.2 Pedestals

Pedestals must be accurately spaced, and set plumb and in true alignment. Set base plates in full and firm contact with the structural floor, and secured to the structural floor with adhesive or steel expansion anchors in accordance with manufacturer's instructions.

#### 3.1.3 Stringers

Interlock stringers with the pedestal caps to preclude lateral movement, spaced uniformly in parallel lines at the indicated elevation.

#### 3.1.4 Auxiliary Framing

Provide auxiliary framing or pedestals around columns and other permanent construction, at sides of ramps, at open ends of the floor, and beneath panels that are substantially cut to accommodate utility systems. Use special framing for additional lateral support as shown on the approved detailed installation drawings. Provide additional pedestals and stringers designed to specific heights and lengths to meet structural irregularities and design loads. Connect auxiliary framing to main framing.

#### 3.1.5 Panels

Interlock panels with supports in a manner that will preclude lateral movement. Fasten perimeter panels, cutout panels, and panels adjoining columns, stairs, and ramps to the supporting components to form a rigid boundary for the interior panels. Level floors within the specified

tolerances. Cut edges of [steel and wood-core panels must be [painted] [finished] [\_\_\_\_\_] as recommended by the panel manufacturer.][ Exposed edges of composite panels must be coated with a silicone rubber sealant or with an adhesive recommended by the panel manufacturer.] Secure extruded vinyl edging in place at all cut edges of all panel cut-outs to prevent abrasion of cables.[ Where the space below the floor is a plenum, close cutouts for conduit and similar penetrations using self-extinguishing sponge rubber or air sealing grommets.]

#### 3.1.6 Carpet Tile

Reference carpet tile paragraph in FLOOR COVERING for carpet tile installation requirements.

#### 3.1.7 Resilient Base

Provide base at vertical wall intersections as indicated in the [drawings] [\_\_\_\_\_]. Apply the base after the floor system has been completely installed. Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

#### 3.1.8 Fascia Plates

Cover exposed floor ends and exposed openings of ramps and stairs with [aluminum] [steel closures] [finish material as indicated on the drawings].

#### 3.1.9 Repair of Zinc Coating

Repair zinc coating that has been damaged, and cut edges of zinc-coated components and accessories, by the application of a galvanizing repair paint conforming to [ASTM A780/A780M](#). Areas to be repaired must be thoroughly cleaned prior to application of the paint.

### 3.2 FIELD TESTS

Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

#### 3.2.1 Acceptance Tests

Conduct acceptance tests after installation of floor system. Make at least one test for each [400] [1000] [\_\_\_\_\_] square feet of floor area. Conduct tests in presence of Contracting Officer and representatives of manufacturer and installer. Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

#### 3.2.2 Air Leakage

When the space below the finished floor is an air plenum, air leakage through the joints between panels and around the perimeter of the floor system must not exceed 0.1 cubic foot of air per minute per linear foot of joint subjected to [.05 inches h2o (Pa)] [0.1 inches h2o (Pa)], water gauge,

positive pressure in the plenum, when tested in accordance with [CISCA Access Floors](#), Section 10 Air Leakage Test. Measure the leakage rate on the finished raised floor system, which may include carpet.

### 3.2.3 Grounding

Ground the access flooring system for safety hazard and static suppression. Provide positive contact between components for safe, continuous electrical grounding of entire floor system. Total system resistance from wearing surface of floor to building grounding electrode must be within range of [0.5 to 20,000 megohms] [0.2 to 2.0 megohms] [0.025 to 1.0 megohms].

#### 3.2.3.1 Metal Grilles

Exposed metal is not allowed at wearing surface of access floor system, except at metal grilles and registers. When grilles and metal registers are provided, insulate as required to provide same grounding resistance as wearing surface.

#### 3.2.3.2 Joint Resistance

Electrical joint resistance between individual stringer and pedestal junctions must be less than 0.1 milliohms. Electrical resistance between stringers and floor panels, as mounted in normal use, must be less than 3 ohms when tested in accordance with [ASTM F150](#).

#### 3.2.4 Electrical Resistance

Conduct testing of electrical resistance, in the completed installation, in the presence of the Contracting Officer in accordance with [NFPA 99](#), modified by placing one electrode on the center of the panel surface and connecting the other electrode to the metal flooring support. Take measurements at five or more locations. Each measurement must be the average of five readings of 15 seconds duration at each location. During the tests, relative humidity must be 45 to 55 percent and temperature set at [69 to 75 degrees F](#). Select panels used in the testing at random and include two panels most distant from the ground connection. Measure electrical resistance with instruments that are accurate within 2 percent and that have been calibrated within 60 days prior to the performance of the resistance tests. The metal-to-metal resistance from panel to supporting pedestal must not exceed 10 ohms. The resistance between the wearing surface of the floor covering and the ground connection, as measured on the completed installation, must be in accordance with paragraph FLOOR COVERING.

#### [3.2.5 SEISMIC SPECIAL INSPECTION AND TESTING

Perform special inspections and testing for seismic-resisting systems and components in accordance with [UFC 3-301-01](#) and Section [01 45 35 SPECIAL INSPECTIONS](#).

### ]3.3 CLEANING AND PROTECTION

#### 3.3.1 Cleaning

Keep the space below the completed floor free of all debris. Before any traffic or other work on the completed raised floor is started, clean the completed floor in accordance with the floor covering manufacturer's

instructions.[ Do not permit seepage of cleaner between individual panels.][ Cleaning of ferrous surfaces must conform to FS TT-C-490.]

### 3.3.2 Protection

Protect traffic areas of raised floor systems with a covering of building paper, fiberboard, or other suitable material to prevent damage to the surface. Cover cutouts with material of sufficient strength to support the loads to be encountered. Place plywood or similar material on the floor to serve as runways for installation of heavy equipment not in excess of design load capacity. Maintain protection until the raised floor system is accepted.

### 3.3.3 Surplus Material Removal

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work. Remove all installation equipment, surplus materials, and rubbish from the work site.

## [3.4 FIRE SAFETY

Install an automatic detection system below the raised floor meeting the requirements of NFPA 75 paragraph 5-2.1 to sound an audible and visual alarm. Air space below the raised floor must be subdivided into areas not exceeding 10,000 square feet by tight, noncombustible bulkheads. Seal all penetrations for piping and cables to maintain bulkhead properties.

## ]3.5 OPERATION AND MAINTENANCE MANUALS

Submit maintenance instructions for proper care of the floor panel surface. When conductive flooring is specified, also submit maintenance instructions to identify special cleaning and maintenance requirements to maintain "conductivity" properties of the panel finish.

-- End of Section --



## SECTION 09 69 19

## STRINGERLESS ACCESS FLOORING

11/15, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30 (2016) Engineered Wood Construction Guide

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

## ASTM INTERNATIONAL (ASTM)

ASTM A780/A780M (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM B85/B85M (2018) Standard Specification for Aluminum-Alloy Die Castings

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E648 (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F150 (2006; R 2013) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

ASTM F1700 (2020) Standard Specification for Solid Vinyl Floor Tile

ASTM F1861 (2021) Standard Specification for Resilient Wall Base

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor

## Sources using Environmental Chambers

## CEILINGS AND INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)

CISCA Access Floors (2007) Recommended Test Procedures for Access Floors

## COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

CPA A208.2 (2016) Medium Density Fiberboard (MDF) for Interior Applications

## GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

## ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC300 (2014) Acceptance Criteria for Access Floors

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

## MASTER PAINTERS INSTITUTE (MPI)

MPI 58 (2012) Stain for Concrete Floors

MPI 99 (2012) Sealer, Water Based, for Concrete Floors

MPI 104 (2012) Sealer, Solvent Based, for Concrete Floors

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure Decorative Laminates

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 75 (2020) Standard for the Protection of Information Technology Equipment

NFPA 99 (2021; TIA 20-1) Health Care Facilities Code

NFPA 253 (2011) Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

## SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113 (2016) Architectural Coatings

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-C-490 (Rev H; 2021) Chemical Conversion Coatings and Pretreatments for Metallic Substrates (Base for Organic Coatings)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Detailed Installation Drawings; G[, [\_\_\_\_]]

Fabrication Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

Access Flooring System; G[, [\_\_\_\_]]

Recycled Content For Access Flooring System; S

Indoor Air Quality For Pedestal Adhesive; S

Indoor Air Quality For Concrete Sealer; S

Indoor Air Quality For Adhesives; S

### SD-04 Samples

Floor Panels

Floor Covering; G[, [\_\_\_\_]]

Panel Support System

Accessories; G[, [\_\_\_\_]]

Fascia; G[, [\_\_\_\_]]

Exposed Step and Ramp Structure; G[, [\_\_\_\_]]

Railings; G[, [\_\_\_\_\_]]

Perforated Directional Air Supply Panels; G[, [\_\_\_\_\_]]

Cut Outs; G[, [\_\_\_\_\_]]

#### SD-05 Design Data

Seismic Calculations

#### SD-06 Test Reports

Factory Tests

Concentrated Load

Uniform Live Load

Rolling Load

Impact Load

Ultimate Load

Pedestal Axial Load

Bonding Strength of Pedestal Adhesive

Electrical Resistance

Field Tests

#### SD-07 Certificates

Compliance with ICC-ES AC308

Compliance with ICC IBC

Certificate of Compliance

Qualification of Manufacturer

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Lifting Device

Warranty; G[, [\_\_\_\_\_]]

### 1.3 SPARE PARTS

[Furnish spare floor panels for each finish including bare panels for carpet tile, complete pedestal assemblies at the rate of one for each 100 or fraction thereof required.][ Provide [four] [\_\_\_\_\_] floor panels

complete with specified floor covering for future use.][ Provide four spare panels with identical floor covering and pedestals for each 1,000 square feet of access flooring and total of 10 linear feet of cut-out trim. Store extra stock in same manner and location as project materials.] [ Provide extra carpet tile from same dye lot consisting of uncut tiles for future maintenance. Provide a minimum of [three] [\_\_\_\_\_] percent of total square yards of each carpet type, pattern, and color. Furnish [[five] [\_\_\_\_\_] percent extra of total adhesive tabs][[one] [\_\_\_\_\_] percent extra of total components] required for installing carpet tile.]

#### 1.4 QUALITY CONTROL

##### 1.4.1 Qualification of Manufacturer

Access flooring manufacturer must have at least 5 years experience in manufacturing access flooring systems. Certify that the manufacturer of the access flooring system meets requirements specified under paragraph entitled QUALIFICATION OF MANUFACTURER.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Delivery

Deliver materials to site in undamaged condition, in original containers or packages, complete with accessories and instructions. Label packages with manufacturer's name and brand designations. Package materials covered by specific references bearing specification number, type and class as applicable.

##### 1.5.2 Storage

Store all materials in original protective packaging in a safe, dry, and clean location. Store panels at temperatures between 40 and 90 degrees F, and between 20 and 70 percent humidity. Replace defective or damaged materials.

##### 1.5.3 Handling

Handle and protect materials in a manner to prevent damage during the entire construction period.

#### 1.6 WARRANTY

Minimum manufacturer warranty must have no dollar limit, cover full system, and must have a minimum duration of [1] [5] [\_\_\_\_\_] years. Include an agreement to repair or replace floor panels or pedestals that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of panels or support system.[ For [high pressure laminate][conductive high pressure laminate][solid vinyl tile][luxury vinyl tile] provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period for finish materials.][ For [conductive][static-dissipative] vinyl tile provide manufacturer's standard performance guarantees or warranties that extend beyond one year, standard warranty must not be less than a five year wear warranty and ten year conductivity warranty.][ For carpet tile provide manufacturer's standard performance guarantees or warranties including a minimum two years for material and workmanship and ten years for wear, static control, tuft bind and delamination.]

## PART 2 PRODUCTS

## 2.1 SYSTEM DESCRIPTION

- a. Provide for self-alignment of floor panels, adjustable pedestals and readily removable floor panels covered as specified.
- b. Make lateral stability of floor support system integral with panels. Finished assembly must be stable and free of vibration, noises, and rocking panels. [ Provide stringerless system with equipotential plane grounding.]
- c. Submit [certificate of compliance](#) attesting that the installed access floor system meets specification requirements, including all special equipment loads and specific electrical and or cable requirements for the complete access flooring system including, but not limited to the following:
  - (1) [Compliance with ICC-ES AC300](#) and [Compliance with ICC IBC](#) Acceptance Criteria for Access Floors.
  - (2) Load-bearing capabilities of pedestals, floor panels, and pedestal adhesive resisting force.
  - (3) Supporting independent laboratory test reports. For panel panel, stringer and pedestal load test results include concentrated loads at center of panel, panel edge midpoint, ultimate loads and uniform loads.
  - (4) Floor electrical characteristics.
  - (5) Material requirements.
  - (6) An elevated floor system free of defects in materials, fabrication, finish, and installation, that will remain so for a period of not less than [\_\_\_\_\_] [1] years after completion.
- d. Submit manufacturer's product data for [access flooring system](#) consisting of descriptive data, catalog cuts, and installation instructions. Include in the data information about any design and production techniques, total system including all accessories and finish coatings of under-floor components, procedures and policies used to conserve energy, reduce material, improve waste management or incorporate green building/recycled products into the manufacturer of their components or products. Include cleaning and maintenance instructions. Systems which contain zinc electroplated anti-corrosion coatings are prohibited.

## 2.1.1 Design Requirements

Conduct floor panel testing in accordance with [CISCA Access Floors](#). When tested as specified, make all deflection and deformation measurements at the point of load application on the top surface of the panel. Floor panels must be capable of supporting the following loads:

- a. [Concentrated load](#) of [1000] [1250] [1500] [2000] [2500] [\_\_\_\_\_] pounds on one square inch, at any point on panel, without a top-surface deflection more than 0.10 inch, and a permanent set not to exceed 0.01 inch in any of the specified tests. Testing must be in accordance with

**CISCA Access Floors**, Section 1 Concentrated Loads with test panels being supported by understructure to be used with installed system instead of steel support blocks.

- b. **Uniform live load** of [250] [300] [350] [400] [500] [\_\_\_\_\_] psf, without a top-surface deflection more than 0.06 inch, and a permanent set not to exceed 0.01 inch in any of the specified tests, when tested in accordance with **CISCA Access Floors**, Section 7 Uniform Load Test with test panels being supported by understructure to be used with installed system instead of steel support blocks.
- c. A **rolling load** of [600] [800] [1000] [1200] [1600] [\_\_\_\_\_] pounds applied through hard rubber surfaced wheel 6 inch diameter by 2 inch wide for 10,000 cycles over the same path. Permanent set at conclusion of test must not exceed 0.040 inch when tested in accordance with **CISCA Access Floors**, Section 3 Rolling Loads.
- d. A **rolling load** of [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds applied through a 3 inch diameter by 1-13/16 inch wide caster for 10 cycles over the same path, without developing a local overall surface deformation greater than 0.04 inch. In accordance with **CISCA Access Floors**, Section 3 Rolling Loads, the permanent deformation limit under rolling load must be satisfied in all of the specified tests.
- e. An **impact load** of [150] pounds anywhere on the panel dropped from a height of 36 inches onto a 1 square inch area without failure of the system, according to **CISCA Access Floors**, Section 8 Drop Impact Load Test.
- f. **Ultimate Load**. Panels must meet manufactures published Ultimate Load rating of [1400] [1800] [2500] [2800] [3100] [\_\_\_\_\_] pounds when tested in accordance with **CISCA Access Floors**, Section 2 Ultimate Loading.
- g. **Safety Factor**. Panels must provide a minimum Safety Factor of 5 times the uniform load specified above in accordance with **ICC-ES AC300**.
- h. **Recycled Content**. Provide Access Flooring System (panels, stringers and pedestals) containing a minimum of [20] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of **recycled content for access flooring system**.

#### 2.1.2 Allowable Tolerances

##### 2.1.2.1 Floor Panel Flatness

Plus or minus 0.035 inches on diagonal on top of panel or underneath edge.

##### 2.1.2.2 Floor Panel Length

Plus or minus 0.015 inch.

##### 2.1.2.3 Floor Panel Squareness

Plus or minus 0.02 inch in panel length.

#### 2.1.3 Pedestals

Pedestals must be capable of supporting a 5000 pound axial load without

permanent deformation, when tested in accordance with [CISCA Access Floors](#), Section 5 [Pedestal Axial Load Test](#).

#### 2.1.4 Bonding Strength of Pedestal Adhesive

Adhesive for anchoring pedestal bases must have a bonding strength capable of resisting an overturning moment of [ 1,000 lbf-in] [ 2,000 lbf-in] [\_\_\_\_\_] when a force is applied to the top of the pedestal in any direction, when tested in accordance with [CISCA Access Floors](#), Section 6 Pedestal Overturning Moment Test. Pedestal adhesive must meet emissions requirement of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type). Provide validation of [indoor air quality for pedestal adhesive](#).

#### 2.1.5 Bond Strength of Factory Installed Covering

Bond strength of floor covering must be sufficient to permit handling of the panels by use of the panel lifting device, and to withstand moving caster loads up to [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds, without separation of the covering from the panel.

#### 2.1.6 Seismic Calculations

##### 2.1.6.1 Navy Project Specific Requirements

Submit seismic calculations for lateral bracing, sealed by a Professional Engineer. Document that access flooring system complies with seismic requirements of [ICC IBC](#) and [ASCE 7-16](#) for Occupancy Importance Factor ( $I_p$ ) of [1.0] [1.5], and seismic horizontal force ( $F_p$ ) determined in accordance with [UFC 3-301-01](#) and Section 1615 of the [ICC IBC](#) and [ASCE 7-16](#), Minimum Design Loads for buildings and other structures.

##### 2.1.6.2 Army Project Specific Requirements

Submit seismic calculations for special bracing to resist the effects of seismic or other forces [in accordance with [UFC 3-301-01](#), [ICC IBC](#) and [ASCE 7-16](#)] [as shown on the approved detailed installation drawings]. Submit design calculations which demonstrate that the proposed floor system meets requirements for seismic loading. Certified copies of test reports may be submitted in lieu of calculations.

#### 2.2 FLOOR PANELS

##### 2.2.1 Floor System Drawings And Planer Quality

- a. Submit [Fabrication Drawings](#) for elevated floor systems consisting of fabrication and assembly details to be performed in the factory.
- b. Indicate on Location Drawings exact location of pedestals, ventilation openings, cable cutouts, and the panel installation pattern.
- c. Provide Detail Drawings showing details of the pedestals, pedestal-floor interlocks, floor panels, panel edging, floor openings, floor opening edging, floor registers, floor grilles, cable cutout treatment, perimeter base, expansion, and peripheral support facilities.
- d. Design and workmanship of the floor, as installed, must be completely planar within plus or minus 0.060 inch in 10 feet, 0.100 inch for the entire floor, and 0.030 inch across panel joints.



- e. Floor-panel joint-width tolerances must not exceed 0.017 inch as measured with a feeler gage at any point in any joint when the panels are installed and as long as the air leakage requirements specified in this section are met.
- f. Submit [three] [\_\_\_\_\_] complete samples of floor panels.

### 2.2.2 Detailed Installation Drawings

Submit Detailed Installation Drawings that as a minimum indicate the following:

- a. Location of panels
- b. Layout of supports, panels, and cutout locations
- c. Stair, handrail, and ramp framing
- d. Sizes and details of components
- e. Details at floor perimeter and height above structural floor
- f. Method of anchorage to structural subfloor
- g. Lateral bracing
- h. Typical cutout details
- i. Gasketing, return air grilles, supply air registers, and perforated panels. Include air transfer capacity of grilles, registers and panels
- j. Description of [shop] [factory] coating
- k. Floor finishes
- l. Location of connection to building grounding electrode

### 2.2.3 Panel Construction

- a. Base access floor system on a 24 by 24 inch square module providing minimum of [6] [12] [\_\_\_\_\_] inch clearance between structural floor and underside of panel. Fabricate so accurate job cutting and fitting may be done using standard sizes for perimeters and around columns.
- b. Do not expose metal on finished top surface of panels. Provide cutouts and cutout closures to accommodate utility systems and equipment intercabling. Reinforce cutouts to meet design load requirements. Provide extra support pedestals at each corner of cutout for cutout panels that do not meet specified design load requirements.
- c. Panel design must provide for convenient panel removal for underfloor servicing and for openings for new equipment. Use panels of uniform dimensions within specified tolerances. Permanently mark panels to indicate load rating and model number.
- d. Machine square floor panels to within plus or minus 0.015 inch with edge straightness plus or minus 0.0025 inch. If plastic edging is applied to the panel, the tolerances apply to the panel before the

plastic edging is applied.

- [ e. Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk corrosion resistant screws with heads that are flush with top of panel.]

#### [2.2.3.1 Aluminum

Provide aluminum panels of die-cast or extruded construction conforming to [ASTM B85/B85M](#).

#### ] [2.2.3.2 Hollow Formed Steel

Steel panels must be of die-formed construction, consisting of a flat steel top sheet welded to one or more formed steel stiffener sheets or components. Panels must be chemically cleaned, bonderized, and painted with the manufacturer's standard finish.

#### ] [2.2.3.3 Cementitious-Filled Formed Steel (Composite Panels)

Provide composite panels of die-formed steel construction totally enclosing the panel, including the top surface. The void spaces between the top sheet and the formed steel bottom sheet must be completely filled with an incombustible cementitious or concrete material. Seal cut edges in accordance with manufacturer's recommendations.

#### ] [2.2.3.4 Metal-Clad Wood Core

Provide wood core panels with cores of wood particleboard conforming to [CPA A208.1](#), Grade 1-M-3, or of plywood conforming to [CPA A208.2](#), [APA E30](#), and [APA L870](#), EXT-DFPA-C-C. The core must be not less than 1 inch thick, and be faced on all sides with structurally bonded zinc-coated steel sheets not lighter than 24 gauge. All edges and corners must be sealed with zinc-coated steel or extruded aluminum. The completed panels must have a flame spread rating of 25 or less when tested in accordance with [ASTM E84](#). Provide zinc-coated steel, extruded aluminum, fire resistant vinyl, or other fire resistant edging to protect shop and field edge cuts and cutouts through the face of panels in a manner to meet specified flame spread, smoke developed and Class A fire rating requirements.

#### ] [2.2.3.5 Lightweight Concrete Filled Panels (Exposed Concrete)

Provide lightweight concrete of lightweight structural concrete with either structural reinforcing or a die-formed, hot dipped galvanized steel bottom pan. All concrete surfaces, including those resulting from field cuts, must be sealed with the manufacturer's standard sealer before covering the surfaces with other materials. Concrete sealer must meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [SCAQMD Rule 1113](#). Provide validation of [indoor air quality for concrete sealer](#).

#### ] 2.2.4 Floor Covering

Surface floor panels with [factory applied finish materials firmly bonded in place with waterproof adhesive] [carpet tile installed in the field]. Provide finish flooring materials in corridors and exits with a critical radiant flux of not less than [0.45 watts per square centimeter (Class 1)] [0.22 watts per square centimeter (Class 2)] when tested in accordance with

ASTM E648 or NFPA 253. The electrical resistance must remain stable over the life expectancy of the floor covering. Any anti-static agent used in the manufacturing process must be an integral part of the material, not surface applied. Bolt heads or similar attachments must not rise above the traffic surface. Submit [three] [\_\_\_\_\_] separate samples of each specified floor covering finish and color.

[2.2.4.1 High Pressure Laminate

Provide factory applied high pressure laminate surfacing conforming to ANSI/NEMA LD 3, High-Wear type, Grade [HDM, 1/16 inch thickness] [\_\_\_\_\_] .Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material] [ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC] [ or ] [ABS] [\_\_\_\_\_] ]. The total system electrical resistance from the wearing surface of the floor to the ground connection must be between 1,000,000 ( $1.0 \times 10^6$ ) ohms and 20,000,000,000 ohms ( $2.0 \times 10^{10}$ ).

] [2.2.4.2 Conductive High Pressure Laminate

Provide factory applied high pressure laminate surfacing conforming to ANSI/NEMA LD 3, High-Wear type, Grade [HDM, 1/16 inch thickness] [\_\_\_\_\_] . Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material] [ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC] [ or ] [ABS] [\_\_\_\_\_] ]. The total system electrical resistance from the wearing surface of the floor to the ground connection must be between 25,000 ohms ( $2.5 \times 10^4$ ) and 1,000,000 ohms ( $1.0 \times 10^6$ ).

] [2.2.4.3 Solid Vinyl Tile

Provide factory applied conductive vinyl tile that is a homogeneous vinyl product and conforms to ASTM F1700, Class I monolithic (minimum wear layer thickness 0.125 inch and minimum overall thickness 0.125 inch), Type A smooth surface. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material] [ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC] [ or ] [ABS] [\_\_\_\_\_] ].

] [2.2.4.4 Luxury Vinyl Tile

Provide factory applied luxury vinyl tile conforming to Class III printed film minimum wear layer thickness of 0.020 inch and minimum overall thickness 0.125 inch, Type [A (smooth)] [B (embossed)]. Finish material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material] [ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC] [ or ] [ABS] [\_\_\_\_\_] ].

] [2.2.4.5 Conductive Vinyl Tile

Provide factory applied conductive vinyl tile that is a homogeneous vinyl product and conforms to ASTM F1700, Class I monolithic, Type A smooth surface. Provide electrical resistance from surface to surface and surface to ground between 25,000 ohms ( $2.5 \times 10^4$ ) and 1,000,000 ohms ( $1.0 \times 10^6$ ) when tested in accordance with ASTM F150. Material must consist of one

piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ] [ABS][ \_\_\_\_\_]].

] [2.2.4.6 Static-Dissipative Vinyl Tile

Provide factory applied static-dissipative vinyl tile that is a homogeneous vinyl product and conforms to **ASTM F1700**, Class I monolithic, Type A smooth surface. Provide electrical resistance from surface to surface and surface to ground between 1,000,000 ohms ( $1.0 \times 10^6$ ) and 1,000,000,000 ohms ( $1.0 \times 10^9$ ) when tested in accordance with **ASTM F150**. Material must consist of one piece to cover the face of the panel. Provide edge detail that is [integral to the finish material][ or ] [is an applied trim piece that finishes the edges of the panel, is flush with floor finish, and is [PVC][ or ] [ABS][ \_\_\_\_\_]].

] [2.2.4.7 Carpet Tile

Reference Section [09 68 00 CARPETING][ and ] [09 62 38 STATIC-CONTROL FLOORING (static-control carpet tile)] for carpet tile specification requirements including recycled content, volatile organic compound (VOC) limits and additional flammability testing requirements for carpet tile. Carpet tile must be field installed and comply with the following:

- a. Installation method on level surfaces must allow carpet tile to be easily removed and replaced in the field and must be installed in accordance with manufacturer's recommended installation instructions.
- b. Install carpet tile in a [monolithic][1/4 turn][ashlar][brick][random][ \_\_\_\_\_] pattern.
- [ c. Install carpet tile on secure and level surfaces offset from the access floor grid with a [manufacturer approved odor-free adhesive tab system][ or ] [with full spread releasable adhesive using manufacturer recommended adhesives. Comply with manufacturer installation instructions for required drying time so the adhesive sets up properly].
- ] [ d. Install carpet tile on secure and level surfaces with the access flooring manufacturer's recommended installation method and components for a one to one alignment with floor panels (one carpet tile to one floor panel); equal to Tate PosiTile[, \_\_\_\_\_] or Haworth CarpetLok. This installation method requires the removal of only one carpet tile to access one raised access panel. Carpet tile size for a one-to-one installation must be slightly smaller than a standard 24 inch by 24 inch tile, coordinate required size with the raised access flooring manufacturer. Factory applied carpet tile with perimeter edge strip and field applied one to one carpet tile installation over raised access floor panels with permanent or releasable adhesive are not acceptable installation methods.]
- [ e. Carpet tile on access flooring stairs and sloped surfaces must be installed with a more permanent installation method in accordance with manufacturer's instructions and with manufacturer recommended adhesives for these types of locations.]

] [2.2.4.8 Lightweight Concrete Filled (Exposed Concrete)

Provide lightweight concrete filled panel with a [MPI 58 concrete stain] [ and ] [[MPI 104 concrete floor sealer] [ or ] [MPI 99 water based concrete floor sealer]]. Apply coatings in accordance with manufacturer's instructions.

#### ]2.2.5 Accessories

Provide the manufacturer's standard registers, grilles, perforated panels, and plenum dividers type where indicated. Provide registers, grilles, and perforated panels designed to support the same static loads as floor panels without structural failure, and capable of delivering the air volumes indicated. Registers and perforated panels must be 25 percent open area and equipped with adjustable dampers. Submit [three] [\_\_\_\_\_] samples and colors of each accessory.

#### 2.2.6 Resilient Base

Conform to ASTM F1861, [[Type TS (vulcanized thermoset rubber)] [or] [Type TP (thermoplastic rubber)]] [, or] [Type TV (thermoplastic vinyl)], [Style A (straight - installed with carpet)] [and] [Style B (coved - installed with resilient flooring)]. Provide [4] [6] inch high and a minimum 1/8 inch thick wall base. Provide [preformed] [job formed] corners in matching height, shape, and color.

#### 2.2.7 Adhesives

Provide adhesives as recommended by the manufacturer. Provide non-aerosol adhesive products that meet either emissions requirements of CDPH SECTION 01350 (use the requirements for either office or classroom, regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives that meet either emissions requirements of CDPH SECTION 01350 (use the requirements for office or classroom, regardless of space type) or VOC content requirements of GS-36. Provide validation of indoor air quality for adhesives. [ Provide conductive adhesive as recommended by the manufacturer of the static-control flooring.] [ Provide conductive releasable adhesive as recommended by the manufacturer for static-control carpet tile.]

#### 2.2.8 Lifting Device

At turnover provide one floor panel lifting device standard with the floor manufacturer, for each individual floor area (room or corridor). Furnish a minimum of two devices. [ For AIR FORCE projects, at turnover, provide a total of two suction-type floor panel lifting devices for each floor area (room or corridor).]

### 2.3 PANEL SUPPORT SYSTEM

Design panel and pedestal support system to allow for 360 degree clearance in laying out cable and cutouts for service to machines. Submit one sample of suspension system proposed for use.

#### 2.3.1 Pedestals

Provide pedestals made of steel or aluminum or a combination thereof. Ferrous materials must have a factory-applied corrosion-resistant finish. Provide pedestal base plates with a minimum of 16 square inches of bearing surface and a minimum of 1/8 inch thickness. Pedestal shafts must be threaded to permit height adjustment within a range of approximately 2

inches, to permit overall floor adjustment within plus or minus 0.10 inch of the required elevation, and to permit leveling of the finished floor surface within 0.062 inch in 10 feet in all directions. Provide locking devices to positively lock the final pedestal vertical adjustments in place. Pedestal caps must interlock with panels to preclude tilting or rocking of the panels.

#### [2.3.2 Gaskets

Provide continuous gasketing at contact surfaces between panel to deaden sound and seal off the underfloor cavity from above for air tightness, and to maintain panel alignment.

#### ]2.4 FASCIA

Provide aluminum or steel fascia plates at open ends of floor, at sides of ramps and steps, and elsewhere as required to enclose the free area under the raised floor. Steel plates must have a factory applied baked enamel finish. Finish on aluminum plates must be standard with the floor system manufacturer. Fascia plates must be reinforced on the back, and supported using the manufacturer's standard lateral bracing at maximum 4 feet on center. Provide trim, angles, and fasteners as required. Submit [three] [\_\_\_\_\_] color samples for fascia.

#### 2.5 STEPS AND RAMPS

Securely fasten steps and ramps to the access flooring system and to the structural floor. Include in the construction standard floor system components and custom components as required, and all supports, fasteners, and trim necessary for a finished installation. Step nosings, threshold strips, and floor bevel strips must be cast or extruded aluminum with non-slip traffic surfaces. Submit [three] [\_\_\_\_\_] color samples for exposed step and ramp structure.

##### 2.5.1 Steps

Height of risers must comply with applicable codes. Design steps to support a uniform load of 150 psf. Surface treads with the manufacturer's standard non-slip floor finish. Floor covering must be [\_\_\_\_\_].

##### 2.5.2 Ramps

Slope of ramps must comply with applicable codes and 36 CFR 1191 Americans with Disabilities Act (ADA). Design ramps to support the same loads as specified for floor panels. Surface ramps with the manufacturer's standard non-slip floor finish. Floor covering must be [\_\_\_\_\_].

#### 2.6 RAILINGS

Provide railings compliant with applicable codes and 36 CFR 1191 Americans with Disabilities Act (ADA). As a minimum railings must be of the double rail and post type, fabricated of at least [1 inch] [\_\_\_\_\_] [round] [square] seamless [aluminum tubing] [\_\_\_\_\_] with a [satin natural anodized] [\_\_\_\_\_] finish. At steps and ramps, make the top rail a minimum of 36 inches high and parallel to the incline. Make the top rail 42 inches high at open ends of the floor. Guardrails must have intermediate rails or an ornamental pattern such that a sphere 4 inches in diameter cannot pass through. Space posts maximum of [4] [5] [6] feet oc. Provide railings complete with anchorages, floor plates, and end caps. [ Electronically

ground hand rails to raised floor system to prevent static build-up.]  
Submit [three] [\_\_\_\_\_] color samples for railings.

## 2.7 FACTORY TESTS

Factory test access flooring, using an independent laboratory, at the same position and maximum design elevation and in the same arrangement as shown on the drawings for installation so as to duplicate service conditions as much as possible.

### 2.7.1 Load Tests

Conduct floor panel and pedestal testing in accordance with **CISCA Access Floors** to determine deformation and permanent set of panels and sytem due to concentrated, Uniform, rolling, impact and ultimate loading when panels are supported by actual understructure.

### 2.7.2 Bond Strength of Covering

Conduct test for bond strength of covering in accordance with **CISCA Access Floors** for rolling loads, except as specified. Panels must be tested with specified hard surface flooring and on the pedestals and stringers as specified for the installed floor. Brace the supports as necessary to prevent sideways movement during the test. Impose a test load of [800] [1000] [1250] [1500] [2000] [\_\_\_\_\_] pounds on the test assembly through a 3 inches in diameter and 1 inch wide hard plastic caster. Roll the caster completely across the center of the panel. The panel must withstand 20 passes of the caster with no delamination or separation of the covering.

## [2.8 REGISTERS AND GRILLES

Registers and grilles must be [\_\_\_\_\_] inches by [\_\_\_\_\_] inches long with a minimum free area of [\_\_\_\_\_] square inches, made from extruded [aluminum] [\_\_\_\_\_] , in [mill] [\_\_\_\_\_] finish, to sustain point loads of 250 pounds per vane without failure or permanent deformation. No part of a grille may project more than 1/8 inch above the floor. Registers and grills are not permitted in a laminate floor tile system.

## ] [2.9 PERFORATED AIR SUPPLY PANELS

Provide air supply floor panels that meet the design criteria specified for standard panels, are fabricated of 14-gage perforated steel sheet welded to minimum 16-gage side channels, are covered with high pressure laminate to match standard panels, and have a uniform perforated pattern to allow even air distribution.

## ] [2.10 PERFORATED DIRECTIONAL AIR SUPPLY PANELS

Provide directional air supply floor panels that meet or exceed the design criteria specified for standard panels, are fabricated of [light weight die cast aluminum with powder coat finish] [welded steel vanes with powder coat finish] [perforated steel sheet welded to a formed steel pan with powder coat finish]. Submit [three] [\_\_\_\_\_] color samples for perforated directional air supply panels

## ] [2.11 CUT OUTS

Provide cable cutouts finished with rigid polyvinylchloride or molded

polypropylene edging to conform to the appearance level of the floor surface and to cover raw edges of the cutout panel. Extrusion must be of a configuration to permit its effective and convenient use when new cable openings are required. Provide at least 24 feet of additional extrusion for future use. Submit [three] [\_\_\_\_\_] color samples for cut outs.

- a. Provide non-metallic adapter for openings less than 4 inches wide. Secure adapter adhesively in cutout to preclude removal from panel. Provide at least two adapters per 1000 square feet for future use.
- b. Openings larger than 4 inches wide must use rigid polyvinylchloride or molded polypropylene edging. Perform cutting of panels, including cutouts, outside of the building.
- c. When size of cutout reduces the performance requirement of panel, provide intermediate pedestals adjacent to cutouts.

#### ] 2.12 EDGE CLOSURE

Provide 1/16 inch aluminum closure plate and extruded aluminum nosing at exposed edge of floor. Back up the closure plates with aluminum or steel framing braced diagonally, or anchor at bottom to continuous angle.

#### ] 2.13 COLOR

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated] [\_\_\_\_\_]. Color listed is not intended to limit the selection of equal colors from other manufacturers.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install access flooring at the location and elevation and in the arrangement shown on the approved detailed installation drawings. The floor system must be of the stringerless type, complete with all supplemental items, and be the standard product of a manufacturer specializing in access flooring systems.

Install the floor system in accordance with the manufacturer's instructions. Open ends of the floor, where the floor system does not abut wall or other construction, must have positive anchorage and rigid support. Maintain areas to receive access flooring between [60] [40] and 90 degrees F, and between 20 and 70 percent humidity for 24 hours prior to and during installation.

##### 3.1.1 Preparation for Installation

Clear out all debris in the area in which the floor system is to be installed. Thoroughly clean structural floor surfaces and remove all dust. Install floor coatings, required for dust or vapor control, prior to installation of pedestals, only if the pedestal adhesive will not damage the coating. If the coating and adhesive are not compatible, apply the coating after the pedestals have been installed and the adhesive has cured.

##### 3.1.2 Pedestals

Pedestals must be accurately spaced, and set plumb and in true alignment. Set base plates in full and firm contact with the structural floor, and



secured to the structural floor with adhesive or steel expansion anchors in accordance with manufacturer's instructions.

### 3.1.3 Auxiliary Framing

Provide auxiliary framing or pedestals around columns and other permanent construction, at sides of ramps, at open ends of the floor, and beneath panels that are substantially cut to accommodate utility systems. Use special framing for additional lateral support as shown on the approved detailed installation drawings. Provide additional pedestals designed to specific heights and lengths to meet structural irregularities and design loads. Connect auxiliary framing to main framing.

### 3.1.4 Panels

Interlock panels with supports in a manner that will preclude lateral movement. Fasten perimeter panels, cutout panels, and panels adjoining columns, stairs, and ramps to the supporting components to form a rigid boundary for the interior panels. Level floors within the specified tolerances. Cut edges of [steel and wood-core panels must be [painted] [finished] [\_\_\_\_\_] as recommended by the panel manufacturer.] [Exposed edges of composite panels must be coated with a silicone rubber sealant or with an adhesive recommended by the panel manufacturer.] Secure extruded vinyl edging in place at all cut edges of all panel cut-outs to prevent abrasion of cables. [ Where the space below the floor is a plenum, close cutouts for conduit and similar penetrations using self-extinguishing sponge rubber or air sealing grommets.]

### 3.1.5 Carpet Tile

Reference carpet tile paragraph in FLOOR COVERING for carpet tile installation requirements.

### 3.1.6 Resilient Base

Provide base at vertical wall intersections as indicated in the [drawings] [\_\_\_\_\_]. Apply the base after the floor system has been completely installed. Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

### 3.1.7 Fascia Plates

Cover exposed floor ends and exposed openings of ramps and stairs with [aluminum] [steel closures] [finish material as indicated].

### 3.1.8 Repair of Zinc Coating

Repair zinc coating that has been damaged, and cut edges of zinc-coated components and accessories, by the application of a galvanizing repair paint conforming to [ASTM A780/A780M](#). Areas to be repaired must be thoroughly cleaned prior to application of the paint.

## 3.2 FIELD TESTS

Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

### 3.2.1 Acceptance Tests

Conduct acceptance tests after installation of floor system. Make at least one test for each [400] [1000] [\_\_\_\_\_] square feet of floor area. Conduct tests in presence of Contracting Officer and representatives of manufacturer and installer. Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

### 3.2.2 Air Leakage

When the space below the finished floor is an air plenum, air leakage through the joints between panels and around the perimeter of the floor system must not exceed 0.1 cubic foot of air per minute per linear foot of joint subjected to [.05 inches h<sub>2</sub>o (Pa)] [0.1 inches h<sub>2</sub>o (Pa)], water gauge, positive pressure in the plenum, when tested in accordance with [CISCA Access Floors](#), Section 10 Air Leakage Test. Measure the leakage rate on the finished raised floor system, which may include carpet.

### 3.2.3 Grounding

Ground the access flooring system for safety hazard and static suppression. Provide positive contact between components for safe, continuous electrical grounding of entire floor system. Total system resistance from wearing surface of floor to building grounding electrode must be within range of [0.5 to 20,000 megohms] [0.2 to 2.0 megohms] [0.025 to 1.0 megohms].

#### 3.2.3.1 Metal Grilles

Exposed metal is not allowed at wearing surface of access floor system, except at metal grilles and registers. When grilles and metal registers are provided, insulate as required to provide same grounding resistance as wearing surface.

#### 3.2.3.2 Joint Resistance

Electrical joint resistance between individual stringer and pedestal junctions must be less than 0.1 milliohms. Electrical resistance between stringers and floor panels, as mounted in normal use, must be less than 3 ohms when tested in accordance with [ASTM F150](#).

### 3.2.4 Electrical Resistance

Conduct testing of electrical resistance, in the completed installation, in the presence of the Contracting Officer in accordance with [NFPA 99](#), modified by placing one electrode on the center of the panel surface and connecting the other electrode to the metal flooring support. Take measurements at five or more locations. Each measurement must be the average of five readings of 15 seconds duration at each location. During the tests, relative humidity must be 45 to 55 percent and temperature set at [69 to 75 degrees F](#). Select panels used in the testing at random and include two panels most distant from the ground connection. Measure electrical resistance with instruments that are accurate within 2 percent and that have been calibrated within 60 days prior to the performance of

the resistance tests. The metal-to-metal resistance from panel to supporting pedestal must not exceed 10 ohms. The resistance between the wearing surface of the floor covering and the ground connection, as measured on the completed installation, must be in accordance with paragraph FLOOR COVERING.

#### [3.2.5 SEISMIC SPECIAL INSPECTION AND TESTING

Perform special inspections and testing for seismic-resisting systems and components in accordance with [UFC 3-301-01](#) and Section [01 45 35 SPECIAL INSPECTIONS](#).

#### ]3.3 CLEANING AND PROTECTION

##### 3.3.1 Cleaning

Keep the space below the completed floor free of all debris. Before any traffic or other work on the completed raised floor is started, clean the completed floor in accordance with the floor covering manufacturer's instructions. [ Do not permit seepage of cleaner between individual panels.] [ Cleaning of ferrous surfaces must conform to [FS TT-C-490](#).]

##### 3.3.2 Protection

Protect traffic areas of raised floor systems with a covering of building paper, fiberboard, or other suitable material to prevent damage to the surface. Cover cutouts with material of sufficient strength to support the loads to be encountered. Place plywood or similar material on the floor to serve as runways for installation of heavy equipment not in excess of design load capacity. Maintain protection until the raised floor system is accepted.

##### 3.3.3 Surplus Material Removal

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work. Remove all installation equipment, surplus materials, and rubbish from the work site.

#### [3.4 FIRE SAFETY

Install an automatic detection system below the raised floor meeting the requirements of [NFPA 75](#) paragraph 5-2.1 to sound an audible and visual alarm. Air space below the raised floor must be subdivided into areas not exceeding [10,000 square feet](#) by tight, noncombustible bulkheads. Seal all penetrations for piping and cables to maintain bulkhead properties.

#### ]3.5 OPERATION AND MAINTENANCE MANUALS

Submit maintenance instructions for proper care of the floor panel surface. When conductive flooring is specified, also submit maintenance instructions to identify special cleaning and maintenance requirements to maintain "conductivity" properties of the panel finish.

-- End of Section --

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## SECTION 09 72 00

## WALLCOVERINGS

08/17, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C423 (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

## GYPSUM ASSOCIATION (GA)

GA 214 (2010) Recommended Levels of Gypsum Board Finish

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 265 (2019) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

NFPA 286 (2019) Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS CCC-W-408 (Rev D; Notices 1, 2, 3) Wallcovering, Vinyl Coated

UNDERWRITERS LABORATORIES (UL)

UL 723 (2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wallcoverings and Accessories; G[, [\_\_\_\_\_]]

Primer and Adhesive

[ Recycled Content for vinyl wallcovering; S]

[ Recycled Content for textile wallcovering; S]

[ Recycled Content for acoustical wallcovering; S]

[ Recycled Content for wallcovering border; S]

SD-04 Samples

Wallcoverings and Accessories; G[, [\_\_\_\_\_]]

SD-07 Certificates

Indoor Air Quality; S

SD-08 Manufacturer's Instructions

Wallcoverings and Accessories

SD-10 Operation and Maintenance Data

Wallcoverings and Accessories; G[, [\_\_\_\_\_]]

### 1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications and validations in one submittal package.

##### 1.3.1.1 Fabrics and Wallcoverings

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.

##### 1.3.1.2 Primers and Adhesives

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver the material to the site in manufacturer's original wrappings and packages and clearly label with the manufacturer's name, brand name, pattern and color name and number, dye lot number, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than [50 degrees F](#) and within a relative humidity range of 30 to 60 percent. Store wallcovering material in a flat position and protected from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Comply with wallcovering manufacturer's printed installation instructions for minimum temperature of area to receive requirements for conditioning adhesive and wallcovering. Provide a minimum [50 degrees F](#) area temperature, 72 hours prior to installation, during installation, and until the adhesive dries. Observe ventilation and safety procedures.

### 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one-year period.

### 1.7 EXTRA MATERIALS

Provide one linear [foot](#) of full-width wallcovering of each pattern and color for each [\[100\]](#) [\[\\_\\_\\_\\_\\_\]](#) linear feet of wallcovering installed[, excluding presentation dry erase wallcovering]. Provide the same manufacturer, type, pattern, color, and lot number of extra stock as the installed wallcovering. Provide full rolls, packed for storage and marked with content, manufacturer's name, pattern and color name and number and dye lot number. Leave extra stock at the site at a location as directed by

the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 WALLCOVERINGS AND ACCESSORIES

Provide wall coverings and accessories material designed specifically for the specified use. Provide vinyl wallcovering and borders with a mercury, cadmium, lead, and chromium free base. Protect wallcoverings with bactericides and mildew inhibitors against microbiological and mildew growth.

#### 2.1.1 Product Data

- a. Wallcovering: Submit manufacturer's descriptive data, documenting physical characteristics, flame resistance, mildew and germicidal characteristics for wallcovering.
- b. Accessories: Submit manufacturer's descriptive data for corner guard and wainscot cap.
- c. Primer and Adhesive: Submit manufacturer's descriptive data, documenting physical characteristics, mildew and germicidal characteristics.

#### 2.1.2 Samples

##### 2.1.2.1 Wallcovering

Submit [three] [\_\_\_\_\_] samples of each indicated type, pattern, and color of wallcovering. Provide minimum 5 by 7 inch samples of wallcovering to show pattern repeat of sufficient size.

##### 2.1.2.2 Accessories

Submit [three] [\_\_\_\_\_] samples of each indicated type corner guard and wainscot cap; provide samples a minimum of 3 inch long. Submit [three] [\_\_\_\_\_] samples of each indicated type of frame for presentation dry erase wallcovering; provide samples a minimum of 3 inch long.

##### [2.1.2.3 Wallcovering

Provide three samples, 3 yards long by the width specified, of each type to be installed in the work, as required to illustrate material weight, color, shade, decorative design, and embossing when required.

##### ] [2.1.2.4 Wallcovering Mockup Panels

After samples are approved, and prior to starting installation, provide a minimum 8 by 8 foot wallcovering mock-up for each color and type of [vinyl] [, ] [fabric] [, and] [presentation dry erase] wallcovering, using the proposed primers and adhesives and actual substrate materials. Once approved, use the mock-up samples as a standard of workmanship for installation within the facility. Written notification to the Contracting Officer at least 48 hours prior to mock-up installation.

##### ] 2.1.3 Certificates

Submit manufacturer's statement attesting that the product furnished meets



or exceeds specification requirements. Date the statement after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified. Include these certificates:

- (1) Certified laboratory test reports of the physical properties for vinyl wallcovering, as specified.
- (2) Certificates of Compliance for UL fire hazard classification listing, as specified.
- (3) Certificates of Compliance for contact adhesive.

#### 2.1.4 Manufacturer's Instructions

Submit preprinted installation instructions for wallcovering and accessories, adhesives and primers. Include substrate preparation and material application in the instructions.

#### 2.1.5 Operations and Maintenance Data

- a. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.
- b. Submit [three] [\_\_\_\_\_] copies of manufacturer's maintenance instructions for each type of vinyl wallcovering and accessory describing recommended type of cleaning equipment and materials, spotting and cleaning methods, and cleaning cycles. Instructions to also include preventative maintenance, recommended cleaning materials and precautions in the use of cleaning materials that may be detrimental to the wallcovering surface and accessories when improperly applied.

#### 2.2 VINYL WALLCOVERING [TYPE [A] [\_\_\_\_\_] ]

Provide a vinyl coated woven or nonwoven wallcovering fabric. Conform to FS CCC-W-408 for vinyl wallcovering, [Type I (Light Duty) with a minimum total weight of [7] [10] ounces/square yard and [10.5] [15] ounces/linear yard] [Type II (Medium Duty) with a minimum total weight of 13 ounces/square yard and 20 ounces/linear yard] [Type III (Heavy Duty) with a minimum total weight of 22 ounces/square yard and 33 ounces/linear yard]. Provide width of [ 52/54 inch] [\_\_\_\_\_] . Test vinyl wallcovering in accordance with NFPA 286 or meet the requirements of Class A when tested in accordance with ASTM E84 or UL 723. [Apply a polyvinyl fluoride (PVF) film, [ 0.00035 inch] [ 0.0005 inch] [ 0.0010 inch] thick over the face of the wallcovering. Provide a transparent (clear) film, medium gloss.]

[Provide Vinyl Wallcovering containing a minimum of [10] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for vinyl wallcovering.]

Provide certification of indoor air quality for vinyl wallcovering.

#### 2.3 TEXTILE WALLCOVERING [TYPE [A] [\_\_\_\_\_] ]

Provide colorfast, stain, and soil resistant textile wallcovering fabricated of woven fabric with paper or acrylic backing. [Test in accordance with NFPA 265 or NFPA 286.] [Meet the requirements of Class A when tested in accordance with ASTM E84 or UL 723.] Comply with or exceed the following for textile wallcovering:

Face fiber content	[_____]
Weave	[Plain] [_____]
Total Weight	[_____] ounces/square yard
Width	[_____] inch

[Provide Textile Wallcovering containing a minimum of [5] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of [recycled content for textile wallcovering.](#)]

Provide certification of indoor air quality for textile wallcovering.

2.4 ACOUSTICAL WALLCOVERING [TYPE [A] [\_\_\_\_\_]]

Provide acoustical wallcovering fabricated of [synthetic material] [vinyl coated fabric with porous surface with fused back] [\_\_\_\_\_]. [Test in accordance with [NFPA 265](#) or [NFPA 286](#).] [Meet the requirements of Class A when tested in accordance with [ASTM E84](#) or [UL 723](#).] Comply with or exceed the following for textile wallcovering:

Total Weight	[_____] ounces/square yard
Width	[_____] inch
NRC rating in accordance with <a href="#">ASTM C423</a>	[_____] inch

Provide Acoustical Wallcovering containing a minimum of 10 percent recycled content. Provide data identifying percentage of [recycled content for acoustical wallcovering.](#)

Provide certification of indoor air quality for acoustical wallcovering.

2.5 WALLCOVERING BORDER [TYPE [A] [\_\_\_\_\_]]

Provide wallcovering border of nonwoven vinyl cellulose/polyester blend or vinyl coated strippable paper back. Comply with or exceed the following for wallcovering border:

Total Weight	[_____] ounces/linear yard
Width	[_____] inch

[Provide Wallcovering Border containing a minimum of [10] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of [recycled content for wallcovering border.](#)]

Provide certification of indoor air quality for wallcovering border.

2.6 PRESENTATION DRY ERASE WALLCOVERING

Provide presentation dry erase wallcovering that accepts dry erase markings [and is designed to be used as a projection screen] [and has a 2 by 2 inch grid pattern]. Provide wallcovering with a minimum total weight of [20] [\_\_\_\_\_] ounces/square yard, a width of [ 60 inch] [\_\_\_\_\_] and backing of a woven or nonwoven polyester. Test wallcovering in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E84 or UL 723. Provide wallcovering color [selected from manufacturer's standard colors] [white] [\_\_\_\_\_] . When frame is required provide [aluminum] [oak] [\_\_\_\_\_] and have a full length tray of the same material. Markings must be removable with a felt eraser or cloth without ghosting. Provide each unit complete with an eraser, four different color compatible dry erase markers, and an 8 ounce bottle of liquid surface cleaner recommended by the manufacturer.

Provide certification of indoor air quality for presentation dry erase wallcovering.

## 2.7 WALL LINER

Provide a non-woven polyester cellulose blend wall liner having a minimum weight of 3.7 ounces/square yard and a total minimum thickness of 0.013 inch. Test wall liner in accordance with NFPA 286 or have a Class A flame spread rating of 0-25 and smoke development rating of 0-450 when tested in accordance with ASTM E84 or UL 723.

Provide certification of indoor air quality for wall liner.

## 2.8 CORNER GUARDS

Provide [ 0.040 inch thick corner guards and cover 3/4 inch] [ 0.075 inch thick corner guards and cover 1 1/8 inch] [ 0.085 inch thick and cover 2 1/2 inch] [\_\_\_\_\_] each side of corner at right angles. Provide [clear] [\_\_\_\_\_] [polycarbonate] [vinyl] [rubber] corner guards from the same color lot.

Provide certification of indoor air quality for corner guards.

## 2.9 WAINSCOT CAP

Provide [[satin-finished extruded aluminum] [\_\_\_\_\_] wainscot cap [3/4] [\_\_\_\_\_] inch high, feathered at bottom edge, with 3/16 inch exposed face on top edge, and grooved to receive the covering] [\_\_\_\_\_] .

## 2.10 PRIMER AND ADHESIVE

Provide a type primer and adhesive recommended by the wallcovering manufacturer, containing a non-mercury based mildewcide, and complying with local indoor air quality standards. Primer must permit removal of the wallcovering and protect the wall surface during removal. Do not damage gypsum wallboard facing paper during removal of wallcovering. Provide a strippable type adhesive. When substrate color variations show through vinyl wallcovering, provide a white pigmented primer as recommended by the wallcovering manufacturer used to conceal the variations. Provide a recommended type adhesive to install corner guards and wainscot cap by the manufacturer of the corner guards and wainscot cap.

Provide primers and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for

either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [GS-36](#). Provide certification or validation of indoor air quality for primer; also, provide certification or validation of indoor air quality for adhesives.

#### 2.11 COLOR, TEXTURE, AND PATTERN

Provide color, texture and pattern in accordance with [Section [09 06 00](#) SCHEDULES FOR FINISHES] [the drawings] [selected from manufacturers standard colors] [      ]. Color listed is not intended to limit the selection of equal colors from other manufacturers].

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Inspect all areas and conditions under which wallcoverings are to be installed. Notify the Contracting Officer, in writing, of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

#### 3.2 SURFACE PREPARATION

Do not apply wallcovering to surfaces that are rough, that contain stains which will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Fill cracks and holes; sand rough spots smooth. Finish walls to receive presentation dry erase wallcovering to a Level 4 gypsum wallboard finish in accordance with [GA 214](#) unless Level 5 is recommended by the wallcovering manufacturer. Thoroughly dry surfaces at least 30 days prior to installation of vinyl wallcovering. Provide interior surfaces of new and existing gypsum wallboard with a wallcovering primer in accordance with the manufacturer's printed instructions. As required, use white primer when substrate color variations are visible through thin or light color wallcovering. Seal interior surfaces of exterior masonry walls to prevent moisture penetration, then prime with a wallcovering primer in accordance with the manufacturer's printed instructions. Provide masonry walls with flush joints. Test moisture content of plaster, concrete, and masonry with an electric moisture meter of a maximum five percent reading. Apply a thin coat of joint compound or cement plaster, as recommended by the wallcovering manufacturer, to the concrete and masonry walls as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, prime the walls as recommended by the wall lining manufacturer. Prime the surfaces of walls as required by the manufacturer's printed instructions to permit ultimate removal of wallcovering from the wall surfaces. Allow primer to completely dry before adhesive application.

#### 3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

##### 3.3.1 Wallcovering

Install wallcovering in accordance with the manufacturer's printed

installation instructions. Remove glue and adhesive spillage from wallcovering face and seams with a remover recommended by the manufacturer.

3.3.1.1 Textile Wallcovering

When textile wallcoverings are specified to comply with NFPA 265, NFPA 286, or ICC IBC (Section 803.5 Textile wall coverings) testing, install the wallcovering in accordance with the manufacturer's printed installation instructions for compliance with the testing using the same product mounting system, including adhesive. After the installation is complete, vacuum the fabric with a ceiling to floor motion.

3.3.1.2 Acoustical Wallcovering

When acoustical wallcoverings are specified to comply with NFPA 265, NFPA 286, or ICC IBC (Section 803.5 Textile wall coverings) testing, install the wallcovering in accordance with the manufacturer's printed installation instructions for compliance with the testing using the same product mounting system, including adhesive. After the installation is complete, vacuum the fabric with a ceiling to floor motion.

3.3.1.3 Presentation Dry Erase Wallcovering Placement

Install presentation dry erase wallcovering [wall-to-wall and floor-to-ceiling] [\_\_\_\_\_] and horizontally on the wall. Make the first seam at [ 24 inch above finished floor for rooms with 8 foot ceilings] [ and ] [ 30 inch above finished floor for rooms with 9 foot ceilings] [\_\_\_\_\_] . Do not make seams at writing height to provide a continual, seamless writing surface. [ Provide wallcovering with an [aluminum] [oak] [\_\_\_\_\_] frame. When frame and tray are required for presentation dry erase wallcovering, install them in accordance with manufacturer's installation instructions. Upon completion of presentation dry erase wallcovering installation, clean the wallcovering surface as recommended by the manufacturer prior to first use. Provide a mounting height of framed wallcovering [as shown on the drawings] [[\_\_\_\_\_] above finished floor to top of the frame.]] Wallcovering locations are [as indicated on drawings.] [as scheduled below:

Room Name and Number	Wall Location	Frame Size
[_____] ]	[_____] ]	[_____] ]

3.3.2 Wall Liner

Install wall liner over masonry walls that are to receive wallcovering. Install liner in accordance with the manufacturer's printed installation instructions. Install liner perpendicular to wallcovering to prevent overlapping of seams between liner and wallcovering.

3.3.3 Corner Guards and Wainscot Cap

Install corner guards and wainscot cap [as indicated on sheet [\_\_\_\_\_] ] [on all exposed corners with [wallcovering] [\_\_\_\_\_] ] and in accordance with the manufacturer's printed instructions. Run corner guards from top of base to [wainscot cap] [ceiling] [\_\_\_\_\_] in a continuous length.

3.4 CLEAN-UP

Upon completion of the work, clean wallcovering free of dirt, soiling, stain, or residual film. Remove and clean surplus materials, rubbish, and debris resulting from the wallcovering installation.

-- End of Section --

## SECTION 09 84 20

## ACOUSTICAL WALL PANELS

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

**AATCC 16** (2004; E 2008; E 2010) Colorfastness to Light

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## ASTM INTERNATIONAL (ASTM)

**ASTM C423** (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

**ASTM D5034** (2009; R 2017) Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)

**ASTM E84** (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

## CALIFORNIA AIR RESOURCES BOARD (CARB)

**CARB 93120** (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

**CDPH SECTION 01350** (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## CSA GROUP (CSA)

**CSA Z809-08** (R2013) Sustainable Forest Management

## FOREST STEWARDSHIP COUNCIL (FSC)

**FSC STD 01 001** (2015) Principles and Criteria for Forest Stewardship

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

## PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013 (2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

## SUSTAINABLE FOREST INITIATIVE (SFI)

SFI 2015-2019 (2015) Standards, Rules for Label Use, Procedures and Guidance

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Approved Detail Drawings; G[, [\_\_\_\_\_]]

## SD-03 Product Data

## Installation

Acoustical Wall Panels; G[, [\_\_\_\_\_]]

Recycled Content for Wood Panels; S

Recycled Content for Fabric Panels; S

Indoor Air Quality for Composite Wood and Agrifiber Products; S

## SD-04 Samples

Acoustical Wall Panels; G[, [\_\_\_\_\_]]

## SD-07 Certificates

Acoustical Wall Panels

Certified Sustainably Harvested Wood; S

## SD-11 Closeout Submittals

Warranty

## [1.3 CERTIFICATIONS

## 1.3.1 Certified Sustainably Harvested Wood



Provide wood certified as sustainably harvested by [FSC STD 01 001](#) [, [ATFS STANDARDS](#), [CSA Z809-08](#), [SFI 2015-2019s](#), or other third party program certified by [PEFC ST 2002:2013](#)]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

#### ]1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

#### 1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

##### 2.1.1 Design

Provide [wood] [fabric wrapped mineral / glass-fiber core] acoustical wall panel materials in the manufacturer's standard sizes and finishes of the type, design and configuration indicated.

##### [2.1.1.1 Wood Recycled Content

Wood Panels must contain a minimum of [50] [\_\_\_\_\_] percent recycled content. Provide data identifying percentage of [recycled content for wood panels](#).

##### ] [2.1.1.2 Sustainably Harvested Wood

Wood Panels must contain a minimum of [50] [\_\_\_\_\_] percent certified sustainably harvested wood. Provide documentation that certified sustainably harvested wood is used and identify percentage.

##### ] [2.1.1.3 Fabric Recycled Content

Fabric Panels must contain a minimum of [\_\_\_\_\_] percent recycled conten. Provide data identifying percentage of [recycled content for fabric panels](#).

Composite wood and agrifiber products must contain no added urea-formaldehyde resins. Products containing composite wood and agrifiber components must meet emissions requirements of either [CARB 93120](#) or [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type). Provide validation of [indoor air quality for composite wood and agrifiber products](#).

#### ]2.2 FABRIC COVERED ACOUSTICAL WALL PANELS

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below manufactured to the dimensions and configurations shown on the [approved detail drawings](#); submit drawings showing plan

locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges must be [non-reinforced.] [reinforced by either an aluminum frame or a formulated resin edge hardener.] Acoustical wall panels installed in non-sprinklered areas must comply with the requirements of ICC IBC, Standard 42-2. Submit manufacturer's descriptive data and catalog cuts; fabric and vinyl swatches, minimum 18 inches wide by 24 inches long [3] [\_\_\_\_\_] samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels must conform to the following:

#### 2.2.1 Panel Width

[Widths must be [24] [30] [48] [60] inches] [End panels may vary in width as necessary to cover wall] [Panel width must be as detailed.]

#### 2.2.2 Panel Height

[Heights must be [96] [108] [120] inches.] [[Field measures panels for custom fit to ceiling.] [Tolerance at floor as detailed].] [Panel height must be as detailed.]

#### 2.2.3 Thickness

[Panel thickness as required to meet the indicated NRC range] [\_\_\_\_\_] .

#### 2.2.4 Fabric Covering

Seamless [non-woven, embossed texture, needle punched 100 percent polyester, minimum 11 ounces/linear yard. Tear strength a minimum 25 pounds machine direction and minimum 40 pounds cross-machine direction. Tensile strength a minimum 50 pounds machine direction and minimum 75 pounds cross-machine direction in accordance with ASTM D5034.] [plain woven 2-ply 100 percent polyester, minimum 15 ounces/linear yard. Tear strength a minimum 29 pounds. Tensile strength 150 pounds minimum in accordance with ASTM D5034.] [perforated vinyl covering with fabric backing, minimum 20 ounces/linear yard total weight.] Stretch fabric covering free of wrinkles and then bond to the edges and back or bond directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer. Light fastness (fadeometer) approximately 40 hours in accordance with AATCC 16.

#### 2.2.5 Fire Rating for the Complete Composite System

Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E84.

#### 2.2.6 Substrate

Fiber glass or mineral fiber

#### 2.2.7 Noise Reduction Coefficient (NRC) Range

[0.50-0.60] [0.80-0.90] [\_\_\_\_\_] ASTM C423

#### 2.2.8 Edge Detail

[Half bevel] [Bevel] [Radius] [Square] [Mitered] [\_\_\_\_\_] edge with fabric wrapped on all four sides.

#### 2.2.9 Core Type

[Standard acoustical] [High impact acoustical] [Acoustical/tackable] [\_\_\_\_\_] core

#### 2.2.10 Mounting Acoustical Panels

Mount acoustical panels by manufacturer's standard [concealed spline] [mechanical fasteners] [magnetic fasteners] [hook and loop] [adhesive mounting] [\_\_\_\_\_].

#### 2.3 COLOR

[In accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [As indicated] [Selected from manufacturers standard colors] [[\_\_\_\_\_]. Color listed is not intended to limit the selection of equal colors from other manufacturers.]

### PART 3 EXECUTION

#### 3.1 SURFACE CONDITIONS

Must be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as, plastering, painting, and concrete are completely dry.

#### 3.2 INSTALLATION

Panel installation must be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

#### 3.3 CLEANING

Following installation, clean dirty or stained panel surfaces in accordance with manufacturer's instructions and leave free from defects. Remove and replace panels that are damaged, discolored, or improperly installed.

-- End of Section --

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## SECTION 09 90 00

## PAINTS AND COATINGS

02/21

## PART 1 GENERAL

## 1.1 RELATED REQUIREMENTS

## 1.1.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

## 1.1.1.1 Exterior Painting

Includes new surfaces[, existing coated surfaces,][ and ][existing uncoated surfaces,] of the building[s] and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

## 1.1.1.2 Interior Painting

Includes new surfaces[, existing uncoated surfaces,][ and ][existing coated surfaces] of the building[s] and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

- a. Exposed columns, girders, beams, joists, and metal deck; and
- b. Other contiguous surfaces.

## 1.1.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, anodized aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

[ f. Do not paint surfaces in the following areas: [\_\_\_\_].

]1.1.3 Mechanical and Electrical Painting

Includes field coating of [interior][ and ][exterior] new[ and existing] surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

- (1) Exposed piping, conduit, and ductwork;
- (2) Supports, hangers, air grilles, and registers;
- (3) Miscellaneous metalwork and insulation coverings.

[ b. Do not paint the following, unless indicated otherwise:

- [ (1) New zinc-coated, aluminum, and copper surfaces under insulation
- ] [ (2) New aluminum jacket on piping
- ] [ (3) New interior ferrous piping under insulation.

]]1.1.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes.

]1.1.4 Exterior Painting of Site Work Items

Field coat the following items:

	New Surfaces	Existing Surfaces
a.		
b.		
c.		

]1.1.5 Miscellaneous Painting

1.1.5.1 Lettering [Building ][Room Number(s)]

Provide lettering [as scheduled on the drawings][block][Gothic] type, [black enamel][water-type decalcomania, finished with a protective coating of spar varnish]. Samples must be approved before application.

[1.1.5.2 Obstructions To Aviation

Paint the following obstructions to aviation in the pattern and color prescribed by FAA AC 70/7460-1: [smokestacks][poles][buildings][\_\_\_\_]

## ]1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100 (2017; Suppl 2020) Documentation of the Threshold Limit Values and Biological Exposure Indices

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A13.1 (2020) Scheme for the Identification of Piping Systems

## ASTM INTERNATIONAL (ASTM)

ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants

ASTM D235 (2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D523 (2014; R 2018) Standard Test Method for Specular Gloss

ASTM D2824/D2824M (2018) Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, and Fibered without Asbestos

ASTM D4214 (2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D4263 (1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D4444 (2013; R 2018) Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters

ASTM D6386 (2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

ASTM F1869 (2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

## CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

Intelligence Bulletin 65 (2013) Occupational Exposure to Carbon Nanotubes and Nanofibers

## MASTER PAINTERS INSTITUTE (MPI)

MPI 1	(2012) Aluminum Paint
MPI 2	(2012) Aluminum Heat Resistant Enamel (up to 427 C and 800 F)
MPI 3	(2016) Primer, Alkali Resistant, Water Based
MPI 4	(2016) Interior/Exterior Latex Block Filler
MPI 5	(2015) Primer, Exterior Alkyd Wood
MPI 6	(2015) Primer, Exterior Latex Wood
MPI 8	(2016) Alkyd, Exterior Flat (MPI Gloss Level 1)
MPI 9	(2016) Alkyd, Exterior Gloss (MPI Gloss Level 6)
MPI 10	(2016) Latex, Exterior Flat (MPI Gloss Level 1)
MPI 11	(2016) Latex, Exterior Semi-Gloss, MPI Gloss Level 5
MPI 13	(2016) Stain, Exterior Solvent-Based, Semi-Transparent
MPI 16	(2016) Stain, Exterior, Water Based, Solid Hide
MPI 17	(2016) Primer, Bonding, Water Based
MPI 19	(2012) Primer, Zinc Rich, Inorganic
MPI 21	(2012) Heat Resistant Coating, (Up to 205°C/402°F), MPI Gloss Level 6
MPI 22	(2012) Aluminum Paint, High Heat (up to 590° C/1100° F)
MPI 23	(2015) Primer, Metal, Surface Tolerant
MPI 27	(2016) Floor Enamel, Alkyd, Gloss (MPI Gloss Level 6)
MPI 31	(2012) Varnish, Polyurethane, Moisture Cured, Gloss (MPI Gloss Level 6)
MPI 38	(2016) Elastomeric Coating, Exterior, Water Based, Non-Flat
MPI 39	(2018) Primer, Latex, for Interior Wood
MPI 42	(2012) Textured Coating, Latex, Flat
MPI 44	(2016) Latex, Interior, (MPI Gloss Level 2)



MPI 45	(2016) Primer Sealer, Interior Alkyd
MPI 46	(2016) Undercoat, Enamel, Interior
MPI 47	(2016) Alkyd, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 48	(2016) Alkyd, Interior, Gloss (MPI Gloss Level 6-7)
MPI 49	(2015) Alkyd, Interior, Flat (MPI Gloss Level 1)
MPI 50	(2015) Primer Sealer, Latex, Interior
MPI 51	(2016) Alkyd, Interior, (MPI Gloss Level 3)2
MPI 52	(2016) Latex, Interior, (MPI Gloss Level 3)
MPI 54	(2016) Latex, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 56	(2012) Varnish, Interior, Polyurethane, Oil Modified, Gloss
MPI 57	(2012) Varnish, Interior, Polyurethane, Oil Modified, Satin
MPI 59	(2016) Floor Paint, Alkyd, Low Gloss
MPI 60	(2016) Floor Paint, Latex, Low Gloss
MPI 68	(2016) Floor Paint, Latex, Gloss
MPI 71	(2012) Varnish, Polyurethane, Moisture Cured, Flat (MPI Gloss Level 1)
MPI 72	(2016) Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)
MPI 76	(2016) Primer, Alkyd, Quick Dry, for Metal
MPI 77	(2015) Epoxy, Gloss
MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
MPI 90	(2012) Stain, Semi-Transparent, for Interior Wood
MPI 94	(2016) Alkyd, Exterior, Semi-Gloss (MPI Gloss Level 5)
MPI 95	(2015) Primer, Quick Dry, for Aluminum
MPI 101	(2016) Primer, Epoxy, Anti-Corrosive, for Metal

MPI 107	(2016) Primer, Rust-Inhibitive, Water Based
MPI 108	(2015) Epoxy, High Build, Low Gloss
MPI 113	(2018) Elastomeric, Pigmented, Exterior, Water Based, Flat
MPI 116	(2012) Block Filler, Epoxy
MPI 119	(2016) Latex, Exterior, Gloss (MPI Gloss Level 6)
MPI 120	(2020) Epoxy, High Build, Self Priming, Low Gloss
MPI 134	(2015) Primer, Galvanized, Water Based
MPI 138	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 2)
MPI 139	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 3)
MPI 140	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 4)
MPI 141	(2016) Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)
MPI 144	(2016) Latex, Interior, Institutional Low Odor/VOC, (MPI Gloss Level 2)
MPI 145	(2016) Latex, Interior, Institutional Low Odor/VOC, ( MPI Gloss Level 3)
MPI 146	(2016) Latex, Interior, Institutional Low Odor/VOC, (MPI Gloss Level 4)
MPI 147	(May 2016) Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (MPI Gloss Level 5)
MPI 149	(2016) Primer Sealer, Interior, Institutional Low Odor/VOC
MPI 151	(2016) Light Industrial Coating, Interior, Water Based (MPI Gloss Level 3)
MPI 153	(2016) Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)
MPI 154	(2016) Light Industrial Coating, Interior, Water Based, Gloss (MPI Gloss Level 6)
MPI 161	(2016) Light Industrial Coating, Exterior, Water Based ( MPI Gloss Level 3)

MPI 163	(2016) Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5)
MPI 164	(2016) Light Industrial Coating, Exterior, Water Based, Gloss (MPI Gloss Level 6)
MPI 177	(2020) Epoxy, Semi-Gloss (MPI Gloss Level 5)
MPI 214	(2016) Latex, Exterior (MPI Gloss Level 2)
MPI ASM	(2019) Architectural Painting Specification Manual
MPI GPS-1-14	(2014) Green Performance Standard GPS-1-14
MPI GPS-2-14	(2014) Green Performance Standard GPS-2-14
MPI MRM	(2015) Maintenance Repainting Manual

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC Glossary	(2011) SSPC Protective Coatings Glossary
SSPC Guide 6	(2015) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 7	(2015) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 2	(2018) Hand Tool Cleaning
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power

	Tool Cleaning
SSPC VIS 4/NACE VIS 7	(1998; E 2000; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting
SSPC-SP WJ-1/NACE WJ-1	(2012) Clean to Bare Substrate, Waterjet Cleaning of Metals
SSPC-SP WJ-2/NACE WJ-2	(2012) Very Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-3/NACE WJ-3	(2012) Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-4/NACE WJ-4	(2012) Light Cleaning, Waterjet Cleaning of Metals
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE AMS-STD-595A	(2017) Colors used in Government Procurement
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual
U.S. DEPARTMENT OF DEFENSE (DOD)	
MIL-PRF-680	(2010; Rev C; Notice 1 2015) Degreasing Solvent
MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders
U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)	
EPA Method 24	(2000) Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings
U.S. FEDERAL AVIATION ADMINISTRATION (FAA)	
FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting
U.S. GENERAL SERVICES ADMINISTRATION (GSA)	
FED-STD-313	(2018) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
29 CFR 1910.1000	Air Contaminants

29 CFR 1910.1001 Asbestos

29 CFR 1910.1025 Lead

29 CFR 1926.62 Lead

### 1.3 DEFINITIONS

#### 1.3.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third-party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

#### 1.3.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing must be accomplished by an MPI testing lab.

#### 1.3.3 Coating

**SSPC Glossary**; (1) A liquid, liquefiable, or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer; (2) Generic term for paint, lacquer, enamel.

#### 1.3.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

#### 1.3.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five levels are generically defined under the Assessment sections in the **MPI MRM**, MPI Maintenance Repainting Manual.

#### 1.3.6 EXT

MPI short term designation for an exterior coating system.

#### 1.3.7 INT

MPI short term designation for an interior coating system.

#### 1.3.8 Loose Paint

Paint or coating that can be removed with a dull putty knife.

#### 1.3.9 mil / mils

The English measurement for 0.001 in or one one-thousandth of an inch.

#### 1.3.10 MPI Gloss Levels

MPI system of defining gloss. Seven gloss levels (G1 to G7) are

generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degree angle	Units at 80 degree angle
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with [ASTM D523](#). Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

#### 1.3.11 MPI System Number

The MPI coating system number in each MPI Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN).

#### 1.3.12 Paint

[SSPC Glossary](#); (1) Any pigmented liquid, liquefiable, or mastic composition designed for application to a substrate in a thin layer that is converted to an opaque solid film after application. Used for protection, decoration, identification, or to serve some other functional purposes; (2) Application of a coating material.

#### 1.3.13 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

#### 1.3.14 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

### 1.4 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs, including [carpets,] [textiles,] [unprimed gypsum wallboard,] [acoustical ceiling panels,] [\_\_\_\_\_].

### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Samples of specified materials may be taken and tested for compliance with specification requirements.

#### SD-02 Shop Drawings

Piping Identification

#### SD-03 Product Data

Coating; G[, [\_\_\_\_]]

Product Data Sheets

Sealant

#### SD-04 Samples

Color; G[, [\_\_\_\_]]

Textured Wall Coating System; G[, [\_\_\_\_]]

[ Sample Textured Wall Coating System Mock-Up; G[, [\_\_\_\_]]

#### ] SD-07 Certificates

Qualification Testing laboratory for coatings; G[, [\_\_\_\_]]

Indoor Air Quality for Paints and Primers

[ Indoor Air Quality for Consolidated Latex Paints

#### ] SD-08 Manufacturer's Instructions

Application Instructions

Mixing

Manufacturer's Safety Data Sheets

#### SD-10 Operation and Maintenance Data

Coatings, Data Package 1; G[, [\_\_\_\_]]

### 1.6 QUALITY ASSURANCE

#### 1.6.1 Regulatory Requirements

##### 1.6.1.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify

Contracting Officer of any paint specified herein which fails to conform.

1.6.1.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.6.1.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.6.1.4 Asbestos Content

Provide asbestos-free materials.

1.6.1.5 Mercury Content

Provide materials free of mercury or mercury compounds.

1.6.1.6 Silica

Provide abrasive blast media containing no free crystalline silica.

1.6.1.7 Human Carcinogens

Provide materials that do not contain ACGIH 0100 confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6.1.8 Carbon Based Fibers / Tubes

Materials must not contain carbon based fibers such as carbon nanotubes or carbon nanofibers. Intelligence Bulletin 65 ranks toxicity of carbon nanotubes on a par with asbestos.

[1.6.2 Coating Contractor's Qualification

Submit the name, address, telephone number, and e-mail address of the Contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on [\_\_\_\_\_] on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address and telephone number of facility owner

Name of individual in facility owner's organization who can be contacted as a reference



Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

] [1.6.3 SSPC QP 1 Certification

Contractors that perform surface preparation or coating application on steel substrates must be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of **SSPC QP 1** prior to Contract award, and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site audits from SSPC and furnish a copy of all audit reports.

] 1.6.4 Approved Products List

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of Contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire Contract and each coating system is to be from a single manufacturer. Provide all coats on a particular substrate from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

1.6.5 Paints and Coatings Indoor Air Quality Certifications

Provide paint and coating products certified to meet indoor air quality requirements by **MPI GPS-1-14**, **MPI GPS-2-14** or provide certification by other third-party programs. Provide current product certification documentation from certification body.

Provide certification of **Indoor Air Quality for Paints and Primers**.  
 [Provide certification of **Indoor Air Quality for Consolidated Latex Paints**.  
 ] Submit required indoor air quality certifications in one submittal package.

1.6.6 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph SAMPLING PROCEDURE. Test each chosen product as specified in the paragraph TESTING PROCEDURE. Remove products from the job site which do not conform, and replace with new products that conform to the referenced specification. Test replacement products that failed initial testing as specified in the paragraph TESTING PROCEDURE at no cost to the Government.

[ Another required testing is Batch Quality Conformance Testing to prove conformance of the manufacturer's paint to the specified MPI standard. This testing is accomplished before the materials are delivered to the job site. Provide testing for [\_\_\_\_\_] paint products. Test paint products as specified in the paragraph TESTING PROCEDURE.

]

## 1.6.6.1 Sampling Procedure

Select paint at random from the products that have been delivered to the job site for sample testing. The Contractor must provide **one quart** samples of the selected paint materials. Take samples in the presence of the Contracting Officer, and label, and identify each sample. Provide labels in accordance with the paragraph PACKAGING, LABELING, AND STORAGE.

## 1.6.6.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide **Qualification Testing** for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph QUALIFICATION TESTING laboratory for coatings. Include the backup data and summary of the test results within the qualification testing lab report. Provide a summary listing of all the reference specification requirements and the result of each test. Clearly indicate in the summary whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If MPI is chosen to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

## 1.6.7 Textured Wall Coating System

Three complete samples of each indicated type, pattern, and color of textured wall coating system applied to a panel of the same material as that on which the coating system will be applied in the work. Provide samples of wall coating systems minimum **5 by 7 inches** and of sufficient size to show pattern repeat and texture.

## [1.6.8 Sample Textured Wall Coating System Mock-Up

After coating samples are approved and prior to starting installation, provide a minimum **8 foot by 8 foot** mock-up for each substrate and for each color and type of textured wall coating using the actual substrate materials. Use the approved mock-up samples as a standard of workmanship for installation within the facility. Submit at least 48 hour advance written notice to the Contracting Officer's Representative prior to mock-up installation.

## ]1.7 PACKAGING, LABELING, AND STORAGE

Provide paints in sealed containers that legibly show the Contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Furnish pigmented paints in containers not larger than **5 gallons**. Store paints and

thinners in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to absorb VOC emissions[, including [\_\_\_\_\_]]. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

## 1.8 SAFETY AND HEALTH

Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. Include in the Activity Hazard Analysis the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

### 1.8.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Safety Data Sheets (SDS) or local regulation.
  - b. 29 CFR 1910.1000.
  - c. ACGIH 0100, threshold limit values.
  - [ d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Removal and disposal of coatings which contain lead is specified in Section 02 83 00 LEAD REMEDIATION. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Coordinate paint preparation activities with this specification section.
  - ] e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Removal and disposal of coatings which contain asbestos materials is specified in Section 02 82 00 ASBESTOS REMEDIATION. Refer to drawings for list of hazardous materials located on this project. Coordinate paint preparation activities with this specification section.
- ] Submit manufacturer's Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

## 1.9 ENVIRONMENTAL REQUIREMENTS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. [ Isolate area of application from rest of building when applying high-emission paints or coatings.]

### 1.9.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;

- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Do not, under any circumstances, violate the manufacturer's application recommendations.

### 1.9.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit Product Data Sheets for specified coatings and solvents. Provide preprinted cleaning and maintenance instructions for all coating systems. Submit Manufacturer's Instructions on Mixing: Detailed mixing instructions, minimum and maximum application temperature and humidity, pot life, and curing and drying times between coats.

### [2.2 COLOR CODING FOR SHORE-TO SHIP UTILITY CONNECTIONS

Color Coding For Shore-To-Ship Utility Connections: Paint hose connection fittings and shut-off valves the designated color. In addition to color coding provide 2 inch high stenciled letters using black stencil paint, clearly designating service for each connection.

Color Coding for Shore-to-Ship		
Utility Connections		
Service	Color	SAE AMS-STD-595A No.
Potable Water*	Blue	15044
Water Provided for Fire Protection**	Red	11105
Chilled Water	Striped Blue/White	15044 / 17886
Oily Waste Water	Striped Yellow/Black	13528 / 17038
Sewer	Gold	17043
Steam	White	17886
High Pressure Air	Gray	16081

Color Coding for Shore-to-Ship		
Low Pressure Air	Tan	10324
Fuels	Yellow	13655
* This includes connections serving domestic functions.		
** This includes non-potable salt water or, at some locations, fresh water connections provided for fire protection (may also include flushing and cooling requirements). Note: This does not include waterfront fire hydrants.		

### ] 2.3 COLOR SELECTION OF FINISH COATS

Provide colors of finish coats as indicated or specified. Allow Contracting Officer to select colors not indicated or specified. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors are approximately the colors indicated and the product conforms to specified requirements.

Provide color, texture, and pattern of wall coating systems [as indicated] [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_\_]. Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated. Submit color stencil codes. Tint each coat progressively darker to enable confirmation of the number of coats.

## PART 3 EXECUTION

### 3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, reinstall removed items by workmen skilled in the trades. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

### [3.2 REPUTTYING AND REGLAZING

Remove cracked, loose, and defective putty or glazing compound on glazed sash and provide new putty or glazing compound. Where defective putty or glazing compound constitutes 30 percent or more of the putty at any one light, remove the glass and putty or glazing compound and reset the glass. Remove putty or glazing compound without damaging sash or glass. Clean rabbets to bare wood or metal and prime prior to reglazing. Provide linseed oil putty for wood sash. Patch surfaces to provide smooth transition between existing and new surfaces. Finish putty or glazing compound to a neat and true bead. Allow glazing compound time to cure, in accordance with manufacturer's recommendation, prior to coating application. Allow putty to set one week prior to coating application.

### ] [3.3 RESEALING OF EXISTING EXTERIOR JOINTS

### 3.3.1 Surface Condition

Begin with surfaces that are clean, dry to the touch, and free from frost and moisture; remove grease, oil, wax, lacquer, paint, defective backstop, or other foreign matter that would prevent or impair adhesion. Where adequate grooves have not been provided, clean out to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to adjoining work. Grinding is not required on metal surfaces.

### 3.3.2 Backstops

In joints more than 1/2 inch deep, install glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free of oil or other staining elements as recommended by sealant manufacturer. Provide backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

### 3.3.3 Primer and Bond Breaker

Install the type recommended by the sealant manufacturer.

### 3.3.4 Ambient Temperature

Between 38 degrees F and 95 degrees F when applying sealant.

### 3.3.5 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color(s) will be selected by the Contracting Officer. Apply the sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Apply sealant uniformly smooth and free of wrinkles.

### 3.3.6 Cleaning

Immediately remove fresh sealant from adjacent areas using a solvent recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean condition. Allow sealant time to cure, in accordance with manufacturer's recommendations, prior to coating.

## ] 3.4 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, [ disintegrated coatings,] and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so that dust and other contaminants will not fall on wet, newly painted surfaces. Spot-prime exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas. Refer to MPI ASM and MPI MRM for additional more specific substrate preparation requirements.

### [3.4.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.
- b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, [ASTM D235](#) or as specified in [MPI MRM](#). Wipe the surfaces dry with a clean, dry, lint free cloth. Wipe immediately preceding the application of the first coat of any coating, unless specified otherwise.
- c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- d. The requirements specified are minimum. Comply also with the [application instructions](#) of the paint manufacturer and specific surface preparation requirements as outlined in [MPI MRM Exterior Surface Preparation and Interior Surface Preparation](#).
- e. Thoroughly clean previously painted surfaces[ specified to be repainted][ damaged during construction] of all grease, dirt, dust or other foreign matter.
- f. Remove blistering, cracking, flaking and peeling or otherwise deteriorated coatings.
- g. Remove chalk so that when tested in accordance with [ASTM D4214](#), the chalk resistance rating is no less than 8.
- h. Roughen slick surfaces. Repair damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls with suitable material to match adjacent undamaged areas.
- i. Feather and sand smooth edges of chipped paint.
- j. Clean rusty metal surfaces in accordance with SSPC requirements. Use solvent, mechanical, or chemical cleaning methods to provide surfaces suitable for painting.
- k. Provide new, proposed coatings that are compatible with existing coatings.

#### ] [3.4.2 Existing Coated Surfaces with Minor Defects

[Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings.][ Remove chalking by sanding[ or blasting] so that when tested in accordance with [ASTM D4214](#), the chalk rating is not less than 8.]

#### ] [3.4.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

- a. Surfaces containing large areas of minor defects;

- b. Surfaces containing more than 20 percent peeling area; and
- c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

#### ]3.4.4 Substrate Repair

- a. Repair substrate surface damaged during coating removal;
- b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and
- c. Clean and prime the substrate as specified.

### 3.5 PREPARATION OF METAL SURFACES

#### 3.5.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: [Solvent clean][ or ][detergent wash] in accordance with **SSPC SP 1** to remove oil and grease. Where shop coat is missing or damaged, clean according to [ **SSPC SP 2**, ] [ **SSPC SP 3**, ] [ **SSPC SP 6/NACE No.3**, ] or [ **SSPC SP 10/NACE No. 2**]. [ Brush-off blast remaining surface in accordance with **SSPC 7/NACE No.4**]; [Water jetting to **SSPC-SP WJ-4/NACE WJ-4** may be used to remove loose coating and other loose materials. Use inhibitor as recommended by coating manufacturer to prevent premature rusting.] Protect shop-coated ferrous surfaces from corrosion by treating and touching up corroded areas immediately upon detection.
- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with [ **SSPC SP 6/NACE No.3 / SSPC-SP WJ-3/NACE WJ-3**] [ **SSPC SP 10/NACE No. 2 / SSPC-SP WJ-2/NACE WJ-2**].
- [ c. Metal Floor Surfaces to Receive Nonslip Coating: Clean in accordance with [ **SSPC SP 10/NACE No. 2**] [ **SSPC-SP WJ-2/NACE WJ-2**].

#### ]3.5.2 Final Ferrous Surface Condition:

##### 3.5.2.1 Tool Cleaned Surfaces

Comply with **SSPC SP 2** and **SSPC SP 3**. Use as a visual reference, photographs in **SSPC VIS 3** for the appearance of cleaned surfaces.

##### 3.5.2.2 Abrasive Blast Cleaned Surfaces

Comply with **SSPC 7/NACE No.4**, **SSPC SP 6/NACE No.3**, and **SSPC SP 10/NACE No. 2**. Use as a visual reference, photographs in **SSPC VIS 1** for the appearance of cleaned surfaces.

##### 3.5.2.3 Waterjet Cleaned Surfaces

Comply with **SSPC-SP WJ-1/NACE WJ-1**, **SSPC-SP WJ-2/NACE WJ-2**, **SSPC-SP WJ-3/NACE WJ-3** or **SSPC-SP WJ-4/NACE WJ-4**. Use as a visual reference, photographs in **SSPC VIS 4/NACE VIS 7** for the appearance of



cleaned surfaces.

### 3.5.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with [solvent, ] [steam, ] [or ] [non-alkaline detergent solution ] in accordance with [SSPC SP 1](#). Completely remove coating by brush-off abrasive blast if the galvanized metal has been passivated or stabilized. Do not "passivate" or "stabilize" new galvanized steel to be coated. If the absence of hexavalent stain inhibitors is not documented, test as described in [ASTM D6386](#), Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to [SSPC-SP WJ-3/NACE WJ-3](#) to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.
- c. Galvanized With Severe Deteriorated Coating or Severe Rusting: [Water jet to [SSPC-SP WJ-3/NACE WJ-3](#) degree of cleanliness.] [ Spot abrasive blast rusted areas as described for steel in [SSPC SP 6/NACE No.3](#), and waterjet to [SSPC-SP WJ-3/NACE WJ-3](#) to remove existing coating.]

### 3.5.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with [SSPC SP 1](#) and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

### 3.5.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, [ASTM D235](#). Wipe dry with clean, dry cloths.

### 3.5.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of [1/2 cup](#) trisodium phosphate, [1/4 cup](#) household detergent, [one quart](#) 5 percent sodium hypochlorite solution and [3 quarts](#) of warm water.

## 3.6 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

### 3.6.1 Concrete and Masonry

- a. Curing: Allow concrete, stucco and masonry surfaces to cure at least 30 days before painting, and concrete slab on grade to cure at least 90 days before painting.
- b. Surface Cleaning: Remove the following deleterious substances.
  - (1) Dirt, [ Chalking,] Grease, and Oil: Wash new[ and existing uncoated] surfaces with a solution composed of [1/2 cup](#) trisodium phosphate, [1/4 cup](#) household detergent, and [4 quarts](#) of warm water. Then rinse thoroughly with fresh water.[ Wash existing coated surfaces with a suitable detergent and rinse thoroughly.] For large areas, water blasting may be used.

- (2) Fungus and Mold: Wash [new][, existing coated,] [and existing uncoated] surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
  - (3) Paint and Loose Particles: Remove by wire brushing.
  - (4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.
  - [ (5) Removal of Existing Coatings: For surfaces to receive textured coating MPI 42, remove existing coatings including soundly adhered coatings if recommended by textured coating manufacturer.
- ] c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.
- d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F1869. In all cases follow manufacturer's recommendations. Allow surfaces to cure a minimum of 30 days before painting.

### 3.6.2 Gypsum Board, Plaster, and Stucco

#### 3.6.2.1 Surface Cleaning

Verify that plaster and stucco surfaces are free from loose matter and that gypsum board is dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint is water-based.

#### 3.6.2.2 Repair of Minor Defects

Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

#### 3.6.2.3 Allowable Moisture Content

Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D4263. Verify that new plaster to be coated has a maximum moisture content of 8 percent, when measured in accordance with ASTM D4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

#### [3.6.3 Existing Asbestos Cement Surfaces

Remove oily stains by solvent cleaning with mineral spirits in accordance with MIL-PRF-680 or ASTM D235. Remove loose dirt, dust, and other deleterious substances by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material. Do not wire brush or clean using other abrasive methods. Verify surfaces are dry and clean prior to application of the coating.

] [3.7 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.7.1 New[, Existing Uncoated,][ and][ Existing Coated] Plywood and Wood Surfaces, Except Floors:

- a. Surface Cleaning: Clean wood surfaces of foreign matter. Verify that surfaces are free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.[ Scrape to remove loose coatings. Lightly sand to roughen the entire area of previously enamel-coated wood surfaces.]
  - [ b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, one ounce (1/3 cup) household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
  - ] c. Do not exceed 12 percent moisture content of the wood as measured by a moisture meter in accordance with ASTM D4444, Method A, unless otherwise authorized.
  - d. Prime or touch up wood surfaces adjacent to surfaces to receive water-thinned paints before applying water-thinned paints.
  - e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.
  - f. Cosmetic Repair of Minor Defects:
    - (1) Knots and Resinous Wood[ and Fire, Smoke, Water, and Color Marker Stained Existing Coated Surface]: Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.
    - (2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.
    - (3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.
  - g. Prime Coat For New Exterior Surfaces: Prime coat [wood doors, ][windows, ][frames, ][and ][trim] before wood becomes dirty, warped[ or weathered].
- 3.7.2 Wood Floor Surfaces, Natural Finish
- a. Initial Surface Cleaning: As specified in Article SURFACE PREPARATION.

- [ b. Existing Loose Boards and Shoe Molding: Before sanding, renail loose boards. Countersink nails and fill with an approved wood filler. Remove shoe molding before sanding and reinstall after completing other work. At Contractor's option, new shoe molding may be provided in lieu of reinstalling old. Provide new wood molding of the same size, wood species, and finish as the existing.
- ] c. Sanding and Scraping: Sanding of wood floors is specified in Section [ 09 64 29 WOOD STRIP AND PLANK FLOORING] [09 64 23 WOOD PARQUET FLOORING] [09 64 66 WOOD ATHLETIC FLOORING] [09 64 00 PORTABLE (DEMOUNTABLE) WOOD FLOORING]. Fill floors of oak or similar open-grain wood with wood filler recommended by the finish manufacturer and the excess filler removed.
- d. Final Cleaning: After sanding, sweep and vacuum floors clean. Do not walk on floors thereafter until specified sealer has been applied and is dry.

### 3.7.3 Interior Wood Surfaces, Stain Finish

Sand interior wood surfaces to receive stain. Fill oak and other open-grain wood to receive stain with a coat of wood filler not less than 8 hours before the application of stain; remove excess filler and sand the surface smooth.

### 3.7.4 Water Blasting of Existing Coated Wood Surfaces:

Provide water blasting for the following surfaces: [\_\_\_\_\_].

- a. Sample Panel: Prior to the initial surface cleaning, water blast a representative surface designated by the Contracting Officer. Provide surface cleaning of the remaining work to match the sample panel approved by the Contracting Officer.
- b. Initial Surface Cleaning: Water blast surfaces to receive paint with a high pressure spray, to remove loose paint, dirt, and other foreign or deleterious materials. Provide working pressure less than 2500 pounds per square inch gage (psig). Do not flood vents or damage windows and floors. If the pressure specified will cause damage to existing wood, advise the Contracting Officer and obtain permission to vary the pressure. Direct the wash nozzle at the surface at an angle of approximately 75 degrees with the surface and at a distance not greater than 5 feet to apply water pressure required to remove loose paint, dirt, chalking, and other foreign matter.
- c. Final Surface Cleaning: After allowing the surfaces to dry for a minimum of 24 hours, remove remaining dirt, splinters, loose particles, disintegrated and loose paint, grease, oil, and other foreign matter from the surface.

## ]3.8 APPLICATION

### 3.8.1 Coating Application

- a. Comply with applicable federal, state and local laws enacted to ensure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

- b. At the time of application, paint must show no signs of deterioration. Maintain uniform suspension of pigments during application.
- c. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Use rollers for applying paints and enamels of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.
- d. Only apply paints, except water-thinned types, to surfaces that are completely free of moisture as determined by sight or touch.
- e. Thoroughly work coating materials into joints, crevices, and open spaces. Pay special attention to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.
- f. Apply each coat of paint so that dry film is of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Completely hide all blemishes.
- g. Touch up damaged coatings before applying subsequent coats. [ Broom clean and clear dust from interior areas before and during the application of coating material.]
- [ h. Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. Upon completion of painting, remove protective covering from sprinkler heads.
- i. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
- j. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil or two component gloss polyurethane (MPI 72) in exterior applications.
- k. Provide labeling on the surfaces of all feed and cross mains to show the pipe function such as "Sprinkler System", "Fire Department Connection", "Standpipe". For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 in in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75 in in height and visible from the floor.

1. All fire suppression system valves must be marked with permanent tags indicating normally open or normally closed.
- ] m. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- n. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Cover each preceding coat or surface completely by ensuring visually perceptible difference in shades of successive coats.
- o. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- p. Thermosetting Paints: Apply topcoats over thermosetting paints (epoxies and urethanes) within the overcoat window recommended by the manufacturer.
- q. Floors: [For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.] [For nonslip surfacing on ramps, provide MPI 77 with non-skid additive, applied by roller in accordance with manufacturer's instructions.]

### 3.8.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. Verify that the written permission includes quantities and types of thinners to use.

When thinning is allowed, thin paints immediately prior to application with not more than **one pint** of suitable thinner per **gallon**. The use of thinner does not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning cannot cause the paint to exceed limits on volatile organic compounds. Do not mix paints of different manufacturers.

### 3.8.3 Two-Component Systems

Mix two-component systems in accordance with manufacturer's instructions. Follow recommendation by the manufacturer for any thinning of the first coat to ensure proper penetration and sealing for each type of substrate.

### 3.8.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table for Exterior Applications	
MPI Division	Substrate Application
MPI Division 3	Exterior Concrete Paint Table
MPI Division 4	Exterior Concrete Masonry Units Paint Table
MPI Division 5	Exterior Metal, Ferrous and Non-Ferrous Paint Table
MPI Division 6	Exterior Wood; Dressed Lumber, Paneling, Decking, Shingles Paint Table
MPI Division 9	Exterior Stucco Paint Table
MPI Division 10	Exterior Cloth Coverings and Bituminous Coated Surfaces Paint Table
Table for Interior Applications	
MPI Division	Substrate Application
MPI Division 3	Interior Concrete Paint Table
MPI Division 4	Interior Concrete Masonry Units Paint Table
MPI Division 5	Interior Metal, Ferrous and Non-Ferrous Paint Table
MPI Division 6	Interior Wood Paint Table
MPI Division 9	Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness, where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat unspecified surfaces the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
- (1) One coat of primer.
  - (2) One coat of undercoat or intermediate coat.
  - (3) One topcoat to match adjacent surfaces.
- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

### 3.9 COATING SYSTEMS FOR METAL

Apply coatings of Tables in MPI Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer to steel surfaces on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat. Overcoat these items with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

### 3.10 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in MPI Division 3, 4 and 9 for Exterior and Interior.

### 3.11 COATING SYSTEMS FOR WOOD AND PLYWOOD

- a. Apply coatings of Tables in MPI Division 6 for Exterior and Interior.
- b. Prior to erection, apply two coats of specified primer to treat and prime wood[ and plywood] surfaces which will be inaccessible after erection.
- c. Apply stains in accordance with manufacturer's printed instructions.
- [ d. Wood Floors to Receive Natural Finish: Thin first coat 2 to 1 using thinner recommended by coating manufacturer. Apply all coatings at rate of 300 to 350 square feet per gallon. Apply second coat not less than 2 hours and not over 24 hours after first coat has been applied. Apply with lamb's wool applicators or roller as recommended by coating manufacturer. Buff or lightly sand between intermediate coats as recommended by coating manufacturer's printed instructions.

### ]3.12 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with [MIL-STD-101] [ASME A13.1]. Place stenciling in clearly visible locations. On piping not covered by [MIL-STD-101] [ASME A13.1], stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.



3.13 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.14 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers. [ Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. When such a service is not available, contact local recyclers to reclaim the materials. ] [ Set aside extra paint for future color matches or reuse by the Government. ] [ Where local options exist for leftover paint recycling, collect all waste paint by type and provide for delivery to recycling or collection facility for reuse by local organizations. ]

3.15 PAINT TABLES

All DFT's are minimum values. [ Use only materials with a MPI GPS-1-14 green check mark having a minimum MPI "Environmentally Friendly" [E1] [E2] [E3] rating based on VOC (EPA Method 24) content levels. ] Acceptable products are listed in the MPI Green Approved Products List, available at <http://www.specifygreen.com/APL/ProductIdxByMPInum.asp>.

3.15.1 Exterior Paint Tables

3.15.1.1 MPI Division 3: Exterior Concrete Paint Table

A. Concrete; Vertical Surfaces, Undersides of Balconies and Soffits

(1) [New and uncoated existing] [ and ] [Existing, previously painted] concrete; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs

Latex					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1A-G1 (Flat)	MPI REX 3.1A-G1 (Flat)	MPI 3	MPI 10	MPI 10	3.5 mils
MPI EXT 3.1A-G2 (Velvet)	MPI REX 3.1A-G2 (Velvet)	MPI 3	MPI 214	MPI 214	3.5 mils

MPI EXT 3.1A-G5 (Semigloss)	MPI REX 3.1A-G5 (Semigloss)	MPI 3	MPI 11	MPI 11	3.5 mils
MPI EXT 3.1A-G6 (Gloss)	MPI REX 3.1A-G6 (Gloss)	MPI 3	MPI 119	MPI 119	3.5 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces.					

(2) [New and uncoated existing] [ and ] [Existing, previously painted] concrete, textured system; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs

Latex Aggregate					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1B-G2 (Flat)	MPI REX 3.1A-G1 (Flat)	MPI 42	MPI 10	MPI 10	N/A
MPI EXT 3.1B-G5 (Semigloss)	MPI REX 3.1A-G5 (Semigloss)	MPI 42	MPI 11	MPI 11	N/A
MPI EXT 3.1B-G6 (Gloss)	MPI REX 3.1A-G6 (Gloss)	MPI 42	MPI 119	MPI 119	N/A
Texture - [Fine] [Medium] [Coarse]. Surface preparation and number of coats in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.					

(3) [New and uncoated existing] [ and ] [Existing, previously painted] concrete, elastomeric system; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs

Elastomeric Coating					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1F-G1 (Flat)	MPI REX 3.1F-G1 (Flat)	Per Manufacturer	MPI 113	MPI 113	16 mils
MPI EXT 3.1F-G2/3 (Velvet)	MPI REX 3.1F-G2/3 (Velvet)	Per Manufacturer	MPI 38	MPI 38	16 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions. NOTE: Apply sufficient coats to achieve a minimum dry film thickness of 16 mils.					

B. Concrete; Swimming Pools

(1) [New and uncoated existing] [ and ] [Existing, previously painted] concrete: Walls and bottom of swimming pools

Swimming Pool Paint					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer
Primer as recommended by manufacturer. Surface preparation and number of coats in accordance with manufacturer's instructions.					

C. Cementitious Composition Board

(1) [New] [ and ] [Existing] Cementitious composition board (including Asbestos cement board)

Latex					
New and uncoated existing	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.3A-G1 (Flat)	MPI REX 3.3A-G1 (Flat)	MPI 10	MPI 10	MPI 10	N/A
MPI EXT 3.3A-G5 (Semigloss)	MPI REX 3.3A-G5 (Semigloss)	MPI 11	MPI 11	MPI 11	N/A
MPI EXT 3.3A-G6 (Gloss)	MPI REX 3.3A-G6 (Gloss)	MPI 119	MPI 119	MPI 119	N/A
Topcoat: Coating to match adjacent surfaces.					

3.15.1.2 MPI Division 4: Exterior Concrete Masonry Units Paint Table

A. [New] [ and ] [Existing] concrete masonry on uncoated surface

Latex						
New	Existing	Block Filler	Primer	Intermediate	Topcoat	System DFT
MPI EXT 4.2A-G1 (Flat)	MPI REX 4.2A-G1 (Flat)	MPI 4	N/A	MPI 10	MPI 10	11 mils

MPI EXT 4.2A-G5 (Semigloss)	MPI REX 4.2A-G5 (Semigloss)	MPI 4	N/A	MPI 11	MPI 11	11 mils
MPI EXT 4.2A-G6 (Gloss)	MPI REX 4.2A-G6 (Gloss)	MPI 4	N/A	MPI 119	MPI 119	11 mils
Topcoat: Coating to match adjacent surfaces.						

B. [New] [ and ] [Existing] concrete masonry, textured system; on uncoated surface

Latex Aggregate					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 4.2B-G1 (Flat)	MPI REX 3.1A-G1 (Flat)	MPI 42	MPI 42	MPI 10	N/A
MPI EXT 4.2B-G5 (Semigloss)	MPI REX 3.1A-G5 (Semigloss)	MPI 42	MPI 42	MPI 11	N/A
MPI EXT 4.2B-G6 (Gloss)	MPI REX 3.1A-G6 (Gloss)	MPI 42	MPI 42	MPI 119	N/A
Texture - [Fine] [Medium] [Coarse]. Surface preparation and number of coats in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.					

C. [New] [ and ] [Existing] concrete masonry, elastomeric system; on uncoated surfaces

Elastomeric Coating					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI EXT 3.1F-G1 (Flat)	MPI REX 3.1F-G1 (Flat)	Per Manufacturer	MPI 113	MPI 113	16 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions. NOTE: Apply sufficient coats of MPI 113 to achieve a minimum dry film thickness of 16 mils.					

3.15.1.3 MPI Division 5: Exterior Metal, Ferrous and Non-Ferrous Paint Table

A. Steel / Ferrous Surfaces

(1) New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1Q-G5 (Semigloss)	MPI REX 5.1D-G5 (Semigloss)	MPI 23	MPI 94	MPI 94	5.25 mils
MPI EXT 5.1Q-G6 (Gloss)	MPI REX 5.1D-G6 (Gloss)	MPI 23	MPI 9	MPI 9	5.25 mils
Topcoat: Coating to match adjacent surfaces.					

(2) New Steel that has been blast-cleaned to SSPC SP 6/NACE No.3

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1D-G5 (Semigloss)	MPI REX 5.1D-G5 (Semigloss)	MPI 79	MPI 94	MPI 94	5.25 mils
MPI EXT 5.1D-G6 (Gloss)	MPI REX 5.1D-G6 (Gloss)	MPI 79	MPI 9	MPI 9	5.25 mils
Topcoat: Coating to match adjacent surfaces.					

(3) Existing steel that has been spot-blasted to SSPC SP 6/NACE No.3

(a) Surface previously coated with alkyd or latex

Waterborne Light Industrial Coating				
Existing, previously coated with alkyd or latex	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1C-G5 (Semigloss)	MPI 79	MPI 163	MPI 163	5 mils
MPI REX 5.1C-G6 (Gloss)	MPI 79	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

(b) Surfaces previously coated with epoxy

Waterborne Light Industrial Coating
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Existing, previously coated with epoxy	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1L-G5 (Semigloss)	MPI 101	MPI 163	MPI 163	5 mils
MPI REX 5.1L-G6 (Gloss)	MPI 101	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
Existing, previously coated with epoxy	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.1H-G6 (Gloss)	MPI 101	MPI 108	MPI 72	8.5 mils
Topcoat: Coating to match adjacent surfaces.				

(4) New [and existing] steel blast cleaned to SSPC SP 10/NACE No. 2

Waterborne Light Industrial					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1R-G5 (Semigloss)	MPI EXT 5.1R-G5 (Semigloss)	MPI 101	MPI 108	MPI 163	8.5 mils
MPI EXT 5.1R-G6 (Gloss)	MPI EXT 5.1R-G6 (Gloss)	MPI 101	MPI 108	MPI 164	8.5 mils
Topcoat: Coating to match adjacent surfaces.					

Pigmented Polyurethane					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1J-G6 (Gloss)	MPI EXT 5.1J-G6 (Gloss)	MPI 101	MPI 108	MPI 72	8.5 mils
Topcoat: Coating to match adjacent surfaces.					

(5) Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations

Epoxy					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1S-G5 (Semi Gloss)	MPI EXT 5.1S-G5 (Semi Gloss)	MPI 120	MPI 177	MPI 177	5.25 mils
MPI EXT 5.1S-G6 (Gloss)	MPI EXT 5.1S-G6 (Gloss)	MPI 120	MPI 77	MPI 77	5.25 mils
Topcoat: Coating to match adjacent surfaces. Load Non-Skid Additive at manufacturer's recommendations.					

B. Exterior Galvanized Surfaces

(1) New Galvanized surfaces

Waterborne Primer / Latex				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3H-G1 (Flat)	MPI 134	MPI 10	MPI 10	4.5 mils
EXT 5.3H-G5 (Semigloss)	MPI 134	MPI 11	MPI 11	4.5 mils
MPI EXT 5.3H-G6 (Gloss)	MPI 134	MPI 119	MPI 119	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Primer / Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3J-G5 (Semigloss)	MPI 134	MPI 163	MPI 163	4.5 mils
MPI EXT 5.3J-G6 (Gloss)	MPI 134	MPI 164	MPI 164	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy Primer / Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT

MPI EXT 5.3K-G5 (Semigloss)	MPI 101	MPI 163	MPI 163	5 mils
MPI EXT 5.3K-G6 (Gloss)	MPI 101	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.3L-G6 (Gloss)	MPI 101	N/A	MPI 72	5 mils
Topcoat: Coating to match adjacent surfaces.				

(2) Galvanized surfaces with slight coating deterioration; little or no rusting

Waterborne Light Industrial Coating				
Galvanized Surfaces with slight coating deterioration	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3J-G5 (Semigloss)	MPI 134	N/A	MPI 163	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
Galvanized Surfaces with slight coating deterioration	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3D-G6 (Gloss)	MPI 101	N/A	MPI 72	5 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Galvanized surfaces with severely deteriorated coating or rusting

Waterborne Light Industrial Coating				
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Galvanized surfaces with severely deteriorated coating or rusting	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3L-G5 (Semigloss)	MPI 101	MPI 108	MPI 163	8.5 mils
MPI REX 5.3L-G6 (Gloss)	MPI 101	MPI 108	MPI 164	8.5 mils
Topcoat: Coating to match adjacent surfaces.				

Pigmented Polyurethane				
Galvanized surfaces with severely deteriorated coating or rusting	Primer	Intermediate	Topcoat	System DFT
MPI REX 5.3D-G6 (Gloss)	MPI 101	MPI 72	MPI 72	5 mils
Topcoat: Coating to match adjacent surfaces.				

C. Exterior Surfaces, Other Metals (Non-Ferrous)

(1) Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment

Alkyd				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.4F-G1 (Flat	MPI 95	MPI 8	MPI 8	5 mils
MPI EXT 5.4F-G5 (Semigloss)	MPI 95	MPI 94	MPI 94	5 mils
MPI EXT 5.4F-G6 (Gloss)	MPI 95	MPI 9	MPI 9	5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Light Industrial Coating				
New Galvanized Surfaces	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.4F-G1 (Flat)	MPI 95	MPI 161	MPI 161	5 mils
MPI EXT 5.4F-G5 (Semigloss)	MPI 95	MPI 163	MPI 163	5 mils
MPI EXT 5.4F-G6 (Gloss)	MPI 95	MPI 164	MPI 164	5 mils
Topcoat: Coating to match adjacent surfaces.				

(2) Existing roof surfaces previously coated

Aluminum Pigmented Asphalt Roof Coating				
Existing roof surfaces previously coated	N/A	Intermediate	Topcoat	System DFT
Non-MPI System	ASTM D2824/D2828	N/A	N/A	8 mils
Sufficient coats to provide not less than 8 mils of finished coating system (without asbestos fibers).				

Aluminum Paint				
Existing roof surfaces previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 10.2D	MPI 107	MPI 1	MPI 1	3.5 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Surfaces adjacent to painted surfaces; [Mechanical,] [Electrical,] [Fire extinguishing sprinkler systems including valves, conduit, hangers, supports,] [exposed copper piping,] [and miscellaneous metal items] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

Alkyd

New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1D-G1 (Flat)	MPI 79	MPI 8	MPI 8	5.25 mils
MPI EXT 5.1D-G5 (Semigloss)	MPI 79	MPI 94	MPI 94	5.25 mils
MPI EXT 5.1D-G6 (Gloss)	MPI 79	MPI 9	MPI 9	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Light Industrial Coating				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 5.1C-G3 (Eggshell)	MPI 79	MPI 161	MPI 161	5 mils
MPI EXT 5.1C-G5 (Semigloss)	MPI 79	MPI 163	MPI 163	5 mils
MPI EXT 5.1C-G6 (Gloss)	MPI 79	MPI 164	MPI 164	5 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces.				

D. Exterior Hot Surfaces

- (1) Hot metal surfaces [including smokestacks] subject to temperatures up to 400 degrees F

Heat Resistant Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2A	MPI 21	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

- (2) Ferrous metal subject to high temperature, up to 750 degrees F

Inorganic Zinc Rich Coating				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2C	MPI 19	N/A	N/A	Per Manufacturer

Surface preparation and number of coats per manufacturer's instructions.

Heat Resistant Aluminum Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2B	MPI 2	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(3) [New surfaces] [ and ] [Existing surfaces] made bare subject to temperatures up to 1100 degrees F

(1) [New surfaces] [ and ] [Existing surfaces] made bare cleaning to SSPC SP 10/NACE No. 2 subject to temperatures up to 1100 degrees F

Heat Resistant Coating					
New	Existing	N/A	Intermediate	Topcoat	System DFT
MPI EXT 5.2D	MPI REX 5.2D	MPI 22	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.					

3.15.1.4 MPI Division 6: Exterior Wood; Dressed Lumber, Paneling, Decking, Shingles Paint Table

A. New [and Existing, uncoated] Dressed lumber, Wood and plywood, trim, [including top, bottom and edges of doors] not otherwise specified

Alkyd					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3B-G5 (Semigloss)	MPI EXT 6.3B-G5 (Semigloss)	MPI 5	MPI 94	MPI 94	5 mils
MPI EXT 6.3B-G6 (Gloss)	MPI EXT 6.3B-G6 (Gloss)	MPI 5	MPI 9	MPI 9	5 mils
Topcoat: Coating to match adjacent surfaces.					

Latex					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3A-G1 (Flat)	MPI EXT 6.3A-G1 (Flat)	MPI 5	MPI 10	MPI 10	5 mils

MPI EXT 6.3A-G5 (Semigloss)	MPI EXT 6.3B-G5 (Semigloss)	MPI 5	MPI 11	MPI 11	5 mils
MPI EXT 6.3A-G6 (Gloss)	MPI EXT 6.3B-G6 (Gloss)	MPI 5	MPI 119	MPI 119	5 mils
Topcoat: Coating to match adjacent surfaces.					

Waterborne Solid Color Stain					
New	Existing, uncoated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3K	MPI EXT 6.3K	MPI 5	MPI 16	MPI 16	4.25 mils
Topcoat: Coating to match adjacent surfaces.					

B. Existing, dressed lumber, Wood and plywood, trim, [including top, bottom and edges of doors] previously coated with an alkyd / oil based finish coat not otherwise specified

Alkyd				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3B-G5 (Semigloss)	MPI 5	MPI 94	MPI 94	5 mils
MPI REX 6.3B-G6 (Gloss)	MPI 5	MPI 9	MPI 9	5 mils

Latex				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3A-G1 (Flat)	MPI 5	MPI 10	MPI 10	5 mils
MPI REX 6.3B-G5 (Semigloss)	MPI 5	MPI 11	MPI 11	5 mils
MPI REX 6.3B-G6 (Gloss)	MPI 5	MPI 119	MPI 119	5 mils

C. Existing, dressed lumber, Wood and plywood, trim, [including top, bottom and edges of doors] previously coated with a latex / waterborne finish coat not otherwise specified

Latex				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.3L-G1 (Flat)	MPI 6	MPI 10	MPI 10	4.5 mils

MPI REX 6.3L-G5 (Semigloss)	MPI 6	MPI 11	MPI 11	4.5 mils
MPI REX 6.3L-G6 (Gloss)	MPI 6	MPI 119	MPI 119	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Waterborne Solid Color Stain				
Existing, previously coated	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3K	MPI 6	MPI 16	MPI 16	4 mils
Topcoat: Coating to match adjacent surfaces.				

D. Wood Siding

(1) New, Uncoated wood siding

Semi-Transparent Stain				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.3D	N/A	MPI 13	MPI 13	N/A
Topcoat: Coating to match adjacent surfaces.				

(2) Existing, previously stained wood siding

Latex				
Existing, previously stained	Primer	Intermediate	Topcoat	System DFT
MPI REX 6.2K-G1 (Flat)	MPI 5	MPI 10	MPI 10	4.5 mils
MPI REX 6.2K-G5 (Semigloss)	MPI 5	MPI 11	MPI 11	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Existing Uncoated or previously semitransparent stained wood siding

Semi-Transparent Stain				
Existing	Primer	Intermediate	Topcoat	System DFT

MPI REX 6.3D	N/A	MPI 13	MPI 13	Per Manufacturer
Topcoat: Coating to match adjacent surfaces.				

E. Wood: [Steps,] [platforms,] [floors of open porches,] and [\_\_\_\_\_] [with non-skid additive (NSA), load at manufacturer's recommendations.]

Latex Floor Paint				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.5A-G2 (Flat)	MPI 5	MPI 60 [plus NSA]	MPI 60 [plus NSA]	4.5 mils
MPI EXT 6.5A-G6 (Gloss)	MPI 5	MPI 68 [plus NSA]	MPI 68 [plus NSA]	4.5 mils
Topcoat: Coating to match adjacent surfaces. Load non-skid additive (NSA) at manufacturer's recommendations.				

Alkyd Floor Paint				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 6.5B-G2 (Flat)	MPI 59	MPI 59 [plus NSA]	MPI 59 [plus NSA]	5 mils
MPI EXT 6.5B-G6 (Gloss)	MPI 27	MPI 27 [plus NSA]	MPI 27 [plus NSA]	5 mils
Topcoat: Coating to match adjacent surfaces. Load non-skid additive (NSA) at manufacturer's recommendations.				

3.15.1.5 MPI Division 9: Exterior Stucco Paint Table

A. [New] [ and Existing] stucco

Latex					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 9.1A-G1 (Flat)	MPI REX 9.1A-G2 (Flat)	MPI 10	MPI 10	MPI 10	4.5 mils
MPI EXT 9.1A-G5 (Semigloss)	MPI REX 9.1A-G5 (Semigloss)	MPI 11	MPI 11	MPI 11	4.5 mils
MPI EXT 9.1A-G6 (Gloss)	MPI REX 9.1A-G6 (Gloss)	MPI 119	MPI 119	MPI 119	4.5 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. On existing stucco, apply primer based on surface condition.					

B. [New] [ and ] [Existing] stucco, elastomeric system

Elastomeric Coating					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI EXT 9.1C-G1 (Flat)	MPI REX 9.1C-G1 (Flat)	N/A	MPI 113	MPI 113	16 mils
Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions Apply sufficient coats of MPI 113 to achieve a minimum dry film thickness of 16 mils.					

3.15.1.6 MPI Division 10: Exterior Cloth Coverings and Bituminous Coated Surfaces Paint Table

A. Insulation and surfaces of insulation coverings (canvas, cloth, paper): (Interior and Exterior Applications)

Latex				
New	Primer	Intermediate	Topcoat	System DFT
MPI EXT 10.1A-G1 (Flat)	N/A	MPI 10	MPI 10	3.2 mils
MPI EXT 10.1A-G5 (Semigloss)	N/A	MPI 11	MPI 11	3.2 mils
MPI EXT 10.1A-G6 (Gloss)	N/A	MPI 119	MPI 119	3.2 mils
Topcoat: Coating to match adjacent surfaces.				

3.15.2 Interior Paint Tables

3.15.2.1 MPI Division 3: Interior Concrete Paint Table

A. [New and uncoated existing] [ and Existing, previously painted] Concrete, vertical surfaces, not specified otherwise

Latex					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1A-G2 (Flat)	MPI RIN 3.1A-G2 (Flat)	MPI 3	MPI 44	MPI 44	4 mils
MPI INT 3.1A-G3 (Eggshell)	MPI RIN 3.1A-G3 (Eggshell)	MPI 3	MPI 52	MPI 52	4 mils



MPI INT 3.1A-G5	MPI RIN 3.1A-G5 (Semigloss)	MPI 3	MPI 54	MPI 54	4 mils
Topcoat: Coating to match adjacent surfaces.					

High Performance Architectural Latex					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1C-G2 (Flat)	MPI RIN 3.1J-G2 (Flat)	MPI 3	MPI 138	MPI 138	4 mils
MPI INT 3.1C-G3 (Eggshell)	MPI RIN 3.1J-G3 (Eggshell)	MPI 3	MPI 139	MPI 139	4 mils
MPI INT 3.1C-G4 (satin)	MPI RIN 3.1J-G4	MPI 3	MPI 140	MPI 140	4 mils
MPI INT 3.1C-G5 (Semigloss)	MPI RIN 3.1J-G5 (Semigloss)	MPI 3	MPI 141	MPI 141	4 mils
Topcoat: Coating to match adjacent surfaces.					

Institutional Low Odor / Low VOC Latex					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1M-G2 (Flat)	MPI RIN 3.1L-G2 (Flat)	MPI 149	MPI 144	MPI 144	4 mils
MPI INT 3.1M-G3 (Eggshell)	MPI RIN 3.1L-G3 (Eggshell)	MPI 149	MPI 145	MPI 145	4 mils
MPI INT 3.1M-G4 (satin)	MPI RIN 3.1L-G4	MPI 149	MPI 146	MPI 146	4 mils
MPI INT 3.1M-G5 (Semigloss)	MPI RIN 3.1L-G5 (Semigloss)	MPI 149	MPI 147	MPI 147	4 mils
Topcoat: Coating to match adjacent surfaces.					

B. Concrete Ceilings, Uncoated

Latex Aggregate				
New, uncoated	Primer	Intermediate	Topcoat	System DFT

MPI INT 3.1N-G1 (Flat)	N/A	N/A	MPI 42	Per Manufacturer
Texture - [Fine] [Medium] [Coarse]. Surface preparation, number of coats, and primer in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.				

C. [New and uncoated existing] [ and ] [Existing, previously painted] Concrete in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [\_\_\_\_\_] [and other high-humidity areas] not otherwise specified except floors

Waterborne Light Industrial Coating					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1L-G3 (Eggshell)	MPI RIN 3.1C-G3 (Eggshell)	MPI 3	MPI 151	MPI 151	4.8 mils
MPI INT 3.1L-G5 (Semigloss)	MPI RIN 3.1C-G5 (Semigloss)	MPI 3	MPI 153	MPI 153	4.8 mils
MPI INT 3.1L-G6 (Gloss)	MPI RIN 3.1C-G6 (Gloss)	MPI 3	MPI 154	MPI 154	4.8 mils
Topcoat: Coating to match adjacent surfaces.					

Alkyd					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1D-G3 (Eggshell)	MPI RIN 3.1D-G3 (Eggshell)	MPI 3	MPI 51	MPI 51	4.5 mils
MPI INT 3.1D-G5 (Semigloss)	MPI RIN 3.1D-G5 (Semigloss)	MPI 3	MPI 47	MPI 47	4.5 mils
MPI INT 3.1D-G6 (Gloss)	MPI RIN 3.1D-G6 (Gloss)	MPI 3	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1F-G6 (Gloss)	MPI RIN 3.1E-G6 (Gloss)	MPI 77	MPI 77	MPI 77	4 mils
Note: Primer may be reduced for penetration per manufacturer's					

D. [New and uncoated existing] [ and Existing, previously painted] concrete

walls and bottom of swimming pools

Chlorinated Rubber					
New and uncoated existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
Chlorinated Rubber	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer	Per Manufacturer
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.1F	MPI RIN 3.1E	MPI 77	MPI 77	MPI 77	4 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

E. [New and uncoated existing] [ and Existing, previously painted] concrete floors in following areas [\_\_\_\_\_]

Latex Floor Paint					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT	MPI RIN	MPI 60	MPI 60	MPI 60	5 mils

Alkyd Floor Paint					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 3.2B-G2 (Flat)	MPI RIN 3.2B-G2 (Flat)	MPI 59	MPI 59	MPI 59	5 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

Epoxy					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT

MPI INT 3.2C-G6 (Gloss)	MPI RIN 3.2C-G6 (Gloss)	MPI 77	MPI 77	MPI 77	5 mils
Note: Primer may be reduced for penetration per manufacturer's instructions.					

3.15.2.2 MPI Division 4: Interior Concrete Masonry Units Paint Table

A. New[ and uncoated Existing] Concrete Masonry

High Performance Architectural Latex					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2D-G2 (Flat)	MPI 4	N/A	MPI 139	MPI 138	11 mils
MPI INT 4.2D-G3 (Eggshell)	MPI 4	N/A	MPI 139	MPI 139	11 mils
MPI INT 4.2D-G4 (Satin)	MPI 4	N/A	MPI 140	MPI 140	11 mils
MPI INT 4.2D-G5 (Semigloss)	MPI 4	N/A	MPI 141	MPI 141	11 mils
Fill all holes in masonry surface					

Institutional Low Odor / Low VOC Latex					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2E-G2 (Flat)	MPI 4	N/A	MPI 144	MPI 144	4 mils
MPI INT 4.2E-G3 (Eggshell)	MPI 4	N/A	MPI 145	MPI 145	4 mils
MPI INT 4.2E-G4 (Satin)	MPI 4	N/A	MPI 146	MPI 146	4 mils
MPI INT 4.2E-G5 (Semigloss)	MPI 4	N/A	MPI 147	MPI 147	4 mils
Fill all holes in masonry surface					

B. Existing, Previously Painted Concrete Masonry

High Performance Architectural Latex
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Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2K-G2 (Flat)	N/A	MPI 138	MPI 138	MPI 138	4.5 mils
MPI RIN 4.2K-G3 (Eggshell)	N/A	MPI 139	MPI 139	MPI 139	4.5 mils
MPI RIN 4.2K-G4	N/A	MPI 140	MPI 140	MPI 140	4.5 mils
MPI RIN 4.2K-G5 (Semigloss)	N/A	MPI 141	MPI 141	MPI 141	4.5 mils

Institutional Low Odor / Low VOC Latex					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2L-G2 (Flat)	N/A	MPI 144	MPI 144	MPI 144	4 mils
MPI RIN 4.2L-G3 (Eggshell)	N/A	MPI 145	MPI 145	MPI 145	4 mils
MPI RIN 4.2L-G4 (Satin)	N/A	MPI 146	MPI 146	MPI 146	4 mils
MPI RIN 4.2L-G5 (Semigloss)	N/A	MPI 147	MPI 147	MPI 147	4 mils

C. New[ and uncoated Existing] Concrete masonry units in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [\_\_\_\_\_,] [and other high humidity areas] unless otherwise specified

Waterborne Light Industrial Coating					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2K-G3 (Eggshell)	MPI 4	N/A	MPI 151	MPI 151	11 mils
MPI INT 4.2K-G5 (Semigloss)	MPI 4	N/A	MPI 153	MPI 153	11 mils
MPI INT 4.2K-G6 (Gloss)	MPI 4	N/A	MPI 154	MPI 154	11 mils
Fill all holes in masonry surface					

Alkyd					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2K-G3 (Eggshell)	MPI 4	MPI 50	MPI 51	MPI 51	12 mils
MPI INT 4.2K-G5 (Semigloss)	MPI 4	MPI 50	MPI 47	MPI 47	12 mils
MPI INT 4.2K-G6 (Gloss)	MPI 4	MPI 50	MPI 48	MPI 48	12 mils
Fill all holes in masonry surface					

Epoxy					
New, uncoated Existing	Filler	Primer	Intermediate	Topcoat	System DFT
MPI INT 4.2G-G6 (Gloss)	MPI 116	N/A	MPI 77	MPI 77	10 mils
Fill all holes in masonry surface					

D. Existing, previously painted, concrete masonry units in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [\_\_\_\_\_,] [and other high humidity areas] unless otherwise specified

Waterborne Light Industrial Coating					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2G-G3 (Eggshell)	N/A	MPI 151	MPI 151	MPI 151	4.5 mils
MPI RIN 4.2G-G5 (Semigloss)	N/A	MPI 153	MPI 153	MPI 153	4.5 mils
MPI RIN 4.2G-G6 (Gloss)	N/A	MPI 154	MPI 154	MPI 154	4.5 mils

Alkyd					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2C-G3 (Eggshell)	N/A	MPI 17	MPI 51	MPI 51	4.5 mils

MPI RIN 4.2C-G5 (Semigloss)	N/A	MPI 17	MPI 47	MPI 47	4.5 mils
MPI RIN 4.2C-G6 (Gloss)	N/A	MPI 17	MPI 48	MPI 48	4.5 mils

Epoxy					
Existing, previously painted	Filler	Primer	Intermediate	Topcoat	System DFT
MPI RIN 4.2D-G6	N/A	MPI 77	MPI 77	MPI 77	5 mils

3.15.2.3 MPI Division 5: Interior Metal, Ferrous and Non-Ferrous Paint Table

A. Interior Steel / Ferrous Surfaces

(1) Metal, [ Mechanical, ] [ Electrical, ] [ Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, ] [ Surfaces adjacent to painted surfaces (Match surrounding finish), ] [ exposed copper piping, ] [ and miscellaneous metal items] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1R-G2 (Flat)	MPI 76	MPI 138	MPI 138	5 mils
MPI INT 5.1R-G3 (Eggshell)	MPI 76	MPI 139	MPI 139	5 mils
MPI INT 5.1R-G5 (Semigloss)	MPI 76	MPI 141	MPI 141	5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G2 (Flat)	MPI 76	MPI 49	MPI 49	5.25 mils
MPI INT 5.1E-G3 (Eggshell)	MPI 76	MPI 51	MPI 51	5.25 mils
MPI INT 5.1E-G5 (Semigloss)	MPI 76	MPI 47	MPI 47	5.25 mils

MPI INT 5.1E-G6 (Gloss)	MPI 76	MPI 48	MPI 48	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

(2) Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations

Alkyd (over q.d. Alkyd Primer)				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G5 (Semi-Gloss)	MPI 76	MPI 47	MPI 47	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1L-G6 (Gloss)	MPI 101	MPI 101	MPI 101	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

(3) Metal in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_\_,][ and other high-humidity areas] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G3 (Eggshell)	MPI 76	MPI 51	MPI 51	5.25 mils
MPI INT 5.1E-G5 (Semigloss)	MPI 76	MPI 47	MPI 47	5.25 mils
MPI INT 5.1E-G6 (Gloss)	MPI 76	MPI 48	MPI 48	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd; For Hand Tool Cleaning



New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1T-G3 (Eggshell)	MPI 23	MPI 51	MPI 51	5.25 mils
MPI INT 5.1T-G5 (Semigloss)	MPI 23	MPI 47	MPI 47	5.25 mils
MPI INT 5.1T-G6 (Gloss)	MPI 23	MPI 48	MPI 48	5.25 mils
Topcoat: Coating to match adjacent surfaces.				

(4) Ferrous metal in concealed damp spaces or in exposed areas having unpainted adjacent surfaces as follows: [\_\_\_\_\_]

Aluminum Paint				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1M	MPI 76	MPI 1	MPI 1	4.25 mils
Topcoat: Coating to match adjacent surfaces.				

(5) Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.4F-G2 (Flat)	MPI 95	MPI 138	MPI 138	5 mils
MPI INT 5.4F-G3 (Eggshell)	MPI 95	MPI 139	MPI 139	5 mils
MPI INT 5.4F-G4 (Satin)	MPI 95	MPI 140	MPI 140	5 mils
MPI INT 5.4F-G5 (Semigloss)	MPI 95	MPI 141	MPI 141	5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd
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New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.4J-G2 (Flat)	MPI 95	MPI 49	MPI 49	5 mils
MPI INT 5.4J-G3 (Eggshell)	MPI 95	MPI 51	MPI 51	5 mils
MPI INT 5.4J-G5 (Semigloss)	MPI 95	MPI 47	MPI 47	5 mils
MPI INT 5.4J-G6 (Gloss)	MPI 95	MPI 48	MPI 48	5 mils
Topcoat: Coating to match adjacent surfaces.				

B. Hot Surfaces

(1) Hot metal surfaces [including smokestacks] subject to temperatures up to 400 degrees F

Heat Resistant Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2A	MPI 21	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

(2) Ferrous metal subject to high temperature, up to 750 degrees F

Inorganic Zinc Rich Coating				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2C	MPI 19	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.				

Heat Resistant Aluminum Enamel				
New	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2B (Aluminum Finish)	MPI 2	N/A	N/A	Per Manufacturer

Surface preparation and number of coats per manufacturer's instructions.

(3) New and Existing Surfaces made bare subject to temperatures up to 1100 degrees F

(1) [New surfaces] [ and ] [Existing surfaces] made bare cleaning to SSPC SP 10/NACE No. 2 subject to temperatures up to 1100 degrees F:

Heat Resistant Coating					
New	Existing	N/A	Intermediate	Topcoat	System DFT
MPI INT 5.2D	MPI RIN 5.2D	MPI 22	N/A	N/A	Per Manufacturer
Surface preparation and number of coats per manufacturer's instructions.					

3.15.2.4 MPI Division 6: Interior Wood Paint Table

A. Interior Wood and Plywood

(1) New[ and Existing, uncoated] Wood and plywood not otherwise specified

High Performance Architectural Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4S-G3 (Eggshell)	MPI 39	MPI 139	MPI 139	4.5 mils
MPI INT 6.4S-G4 (Satin)	MPI 39	MPI 140	MPI 140	4.5 mils
MPI INT 6.4S-G5 (Semigloss)	MPI 39	MPI 141	MPI 141	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4B-G3 (Eggshell)	MPI 45	MPI 51	MPI 51	4.5 mils
MPI INT 6.4B-G5 (Semigloss)	MPI 45	MPI 47	MPI 47	4.5 mils
MPI INT 6.4B-G6 (Gloss)	MPI 45	MPI 48	MPI 48	4.5 mils

Topcoat: Coating to match adjacent surfaces.

Institutional Low Odor / Low VOC Latex				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3V-G2 (Flat)	MPI 39	MPI 144	MPI 144	4 mils
MPI INT 6.3V-G3 (Eggshell)	MPI 39	MPI 145	MPI 145	4 mils
MPI INT 6.3V-G4 (Satin)	MPI 39	MPI 146	MPI 146	4 mils
MPI INT 6.3V-G5 (Semigloss)	MPI 39	MPI 147	MPI 147	4 mils

(2) Existing, previously painted Wood and plywood not otherwise specified

High Performance Architectural Latex				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.4B-G3 (Eggshell)	MPI 39	MPI 139	MPI 139	4.5 mils
MPI RIN 6.4B-G4 (Satin)	MPI 39	MPI 140	MPI 140	4.5 mils
MPI RIN 6.4B-G5 (Semigloss)	MPI 39	MPI 141	MPI 141	4.5 mils

Topcoat: Coating to match adjacent surfaces.

Alkyd				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.4C-G3 (Eggshell)	MPI 46	MPI 51	MPI 51	4.5 mils
MPI RIN 6.4C-G5 (Semigloss)	MPI 46	MPI 47	MPI 47	4.5 mils
MPI RIN 6.4C-G6 (Gloss)	MPI 46	MPI 48	MPI 48	4.5 mils

Topcoat: Coating to match adjacent surfaces.

Institutional Low Odor / Low VOC Latex				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.4D-G2 (Flat)	MPI 39	MPI 144	MPI 144	4 mils
MPI RIN 6.4D-G3 (Eggshell)	MPI 39	MPI 145	MPI 145	4 mils
MPI RIN 6.4D-G4 (Satin)	MPI 39	MPI 146	MPI 146	4 mils
MPI RIN 6.4D-G5 (Semigloss)	MPI 39	MPI 147	MPI 147	4 mils

B. Interior New [and Existing, previously finished or stained] Wood and Plywood, except floors; natural finish or stained

Natural finish, oil-modified polyurethane					
New	Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4J-G4	MPI RIN 6.4L-G4	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.4J-G6 (Gloss)	MPI RIN 6.4L-G6 (Gloss)	MPI 56	MPI 56	MPI 56	4 mils

Stained, oil-modified polyurethane						
New	Existing	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4E-G4	MPI RIN 6.4G-G4	MPI 90	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.4E-G6 (Gloss)	MPI RIN 6.4G-G6 (Gloss)	MPI 90	MPI 56	MPI 56	MPI 56	4 mils

Stained, Moisture Cured Urethane						
New	Existing	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4V-G2 (Flat)	MPI RIN 6.4V-G2 (Flat)	MPI 90	MPI 71	MPI 71	MPI 71	4 mils
MPI INT 6.4V-G6 (Gloss)	MPI RIN 6.4V-G6 (Gloss)	MPI 90	MPI 31	MPI 31	MPI 31	4 mils

C. Interior New[ and Existing, previously finished or stained] Wood

Floors; Natural finish or stained

Natural finish, oil-modified polyurethane					
New	Existing, previously finished or stained	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5C-G6 (Gloss)	MPI RIN 6.5C-G6 (Gloss)	MPI 56	MPI 56	MPI 56	4 mils

Natural finish, Moisture Cured Polyurethane					
New	Existing, previously finished or stained	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5K-G6 (Gloss)	MPI RIN 6.5D-G6 (Gloss)	MPI 31	MPI 31	MPI 31	4 mils

Stained, oil-modified polyurethane						
New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5B-G6 (Gloss)	MPI RIN 6.5B-G6 (Gloss)	MPI 90	MPI 56	MPI 56	MPI 56	4 mils

Stained, Moisture Cured Urethane						
New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4V-G6 (Gloss)	MPI RIN 6.4V-G6 (Gloss)	MPI 90	MPI 31	MPI 31	MPI 31	4 mils

D. New [and Existing, previously coated] Wood floors; pigmented finish

Latex Floor Paint					
New	Existing, previously finished	Primer	Intermediate	Topcoat	System DFT

MPI INT 6.5G-G2 (Flat)	MPI RIN 6.5J-G2 (Flat)	MPI 45	MPI 60	MPI 60	4.5 mils
MPI INT 6.5G-G6 (Gloss)	MPI RIN 6.5J-G6 (Gloss)	MPI 45	MPI 68	MPI 68	4.5 mils
Topcoat: Coating to match adjacent surfaces.					

Alkyd Floor Paint					
New	Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.5A-G2 (Flat)	MPI RIN 6.5A-G2 (Flat)	MPI 59	MPI 59	MPI 59	4.5 mils
MPI INT 6.5A-G6 (Gloss)	MPI RIN 6.5A-G6 (Gloss)	MPI 27	MPI 27	MPI 27	4.5 mils
Topcoat: Coating to match adjacent surfaces.					

E. Interior New[ and Existing, uncoated] wood surfaces in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_\_][ and other high humidity areas] not otherwise specified

High-Build Glaze Coatings
As specified in Section 09 96 59 HIGH-BUILD GLAZE COATINGS.

Waterborne Light Industrial				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3P-G5 (Semigloss)	MPI 45	MPI 153	MPI 153	4.5 mils
MPI INT 6.3P-G6 (Gloss)	MPI 45	MPI 154	MPI 154	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd

New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3B-G5 (Semigloss)	MPI 45	MPI 47	MPI 47	4.5 mils
MPI INT 6.3B-G6 (Gloss)	MPI 45	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

F. Existing, previously painted wood surfaces in[ toilets,][ food-preparation,][ food-serving,][ restrooms,][ laundry areas,][ shower areas,][ areas requiring a high degree of sanitation,][ \_\_\_\_][ and other high humidity areas] not otherwise specified

High-Build Glaze Coatings
As specified in Section 09 96 59 HIGH-BUILD GLAZE COATINGS.

Waterborne Light Industrial				
Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.3P-G5 (Semigloss)	MPI 39	MPI 153	MPI 153	4.5 mils
MPI RIN 6.3P-G6 (Gloss)	MPI 39	MPI 154	MPI 154	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

Alkyd				
Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.3B-G5 (Semigloss)	MPI 46	MPI 47	MPI 47	4.5 mils
MPI RIN 6.3B-G6 (Gloss)	MPI 46	MPI 48	MPI 48	4.5 mils
Topcoat: Coating to match adjacent surfaces.				

G. Interior New [and Existing, previously finished or stained] Wood Doors; Natural Finish or Stained

Natural finish, oil-modified polyurethane					
New	Existing, previously finished or stained	Primer	Intermediate	Topcoat	System DFT



MPI INT 6.3K-G4	MPI RIN 6.3K-G4	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.3K-G6 (Gloss)	MPI RIN 6.3K-G6 (Gloss)	MPI 56	MPI 56	MPI 56	4 mils

Note: Sand between all coats per manufacturers recommendations.

Stained, oil-modified polyurethane

New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3E-G4	MPI RIN 6.3E-G4	MPI 90	MPI 57	MPI 57	MPI 57	4 mils
MPI INT 6.5B-G6 (Gloss)	MPI RIN 6.5B-G6 (Gloss)	MPI 90	MPI 56	MPI 56	MPI 56	4 mils

Note: Sand between all coats per manufacturers recommendations.

Stained, Moisture Cured Urethane

New	Existing, previously finished or stained	Stain	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.4V-G2 (Flat)	MPI RIN 6.4V-G2 (Flat)	MPI 90	MPI 71	MPI 71	MPI 71	4 mils
MPI INT 6.4V-G6 (Gloss)	MPI RIN 6.4V-G6 (Gloss)	MPI 90	MPI 31	MPI 31	MPI 31	4 mils

Note: Sand between all coats per manufacturers recommendations.

H. New [ and Existing, uncoated] Wood Doors; Pigmented finish

Alkyd

New, uncoated	Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.3B-G5 (Semigloss)		MPI 45	MPI 47	MPI 47	4.5 mils
MPI INT 6.3B-G6 (Gloss)		MPI 45	MPI 48	MPI 48	4.5 mils

Note: Sand between all coats per manufacturers recommendations.

Pigmented Polyurethane

New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 6.1E-G6 (Gloss)	MPI 72	MPI 72	MPI 72	4.5 mils
Note: Sand between all coats per manufacturers recommendations.				

I. Existing, previously painted Wood Doors; Pigmented finish

Alkyd				
Existing, previously finished	Primer	Intermediate	Topcoat	System DFT
MPI RIN 6.3B-G5 (Semigloss)	MPI 46	MPI 47	MPI 47	4.5 mils
MPI RIN 6.3B-G6 (Gloss)	MPI 46	MPI 48	MPI 48	4.5 mils
Note: Sand between all coats per manufacturers recommendations.				

3.15.2.5 MPI Division 9: Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

A. Interior New[ and Existing, previously painted] [ Plaster] [ and] [ Wallboard] not otherwise specified

Latex					
New	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2A-G2 (Flat)	RIN 9.2A-G2 (Flat)	MPI 50	MPI 44	MPI 44	4 mils
MPI INT 9.2A-G3 (Eggshell)	RIN 9.2A-G3 (Eggshell)	MPI 50	MPI 52	MPI 52	4 mils
MPI INT 9.2A-G5 (Semigloss)	RIN 9.2A-G5 (Semigloss)	MPI 50	MPI 54	MPI 54	4 mils
Topcoat: Coating to match adjacent surfaces.					

High Performance Architectural Latex - High Traffic Areas					
New	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2B-G2 (Flat)	MPI RIN 9.2B-G2 (Flat)	MPI 50	MPI 138	MPI 138	4 mils

MPI INT 9.2B-G3 (Eggshell)	MPI RIN 9.2B-G3 (Eggshell)	MPI 50	MPI 139	MPI 139	4 mils
MPI INT 9.2B-G5 (Semigloss)	MPI RIN 9.2B-G5 (Semigloss)	MPI 50	MPI 141	MPI 141	4 mils
Topcoat: Coating to match adjacent surfaces.					

Institutional Low Odor / Low VOC Latex, New

Institutional Low Odor / Low VOC Latex				
New	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2M-G2 (Flat)	MPI 149	MPI 144	MPI 144	4 mils
MPI INT 9.2M-G3 (Eggshell)	MPI 149	MPI 145	MPI 145	4 mils
MPI INT 9.2M-G4 (Satin)	MPI 149	MPI 146	MPI 146	4 mils
MPI INT 9.2M-G5 (Semigloss)	MPI 149	MPI 147	MPI 147	4 mils
Topcoat: Coating to match adjacent surfaces.				

Institutional Low Odor / Low VOC Latex, Existing, previously painted

Institutional Low Odor / Low VOC Latex				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 9.2M-G2 (Flat)	MPI 144	MPI 144	MPI 144	4 mils
MPI RIN 9.2M-G3 (Eggshell)	MPI 144	MPI 145	MPI 145	4 mils
MPI RIN 9.2M-G4 (Satin)	MPI 144	MPI 146	MPI 146	4 mils
MPI RIN 9.2M-G5 (Semigloss)	MPI 144	MPI 147	MPI 147	4 mils
Topcoat: Coating to match adjacent surfaces.				

B. Interior New[ and Existing, previously painted] [ Plaster] [ and] [ Wallboard] in[ toilets,] [ food-preparation,] [ food-serving,] [ restrooms,] [ laundry areas,] [ shower areas,] [ areas requiring a high degree of sanitation,] [ \_\_\_\_\_] [ and other high humidity areas] not otherwise specified

Waterborne Light Industrial Coating					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2L-G5 (Semigloss)	MPI RIN 9.2L-G5 (Semigloss)	MPI 50	MPI 153	MPI 153	4 mils
Topcoat: Coating to match adjacent surfaces.					

Alkyd					
New, uncoated Existing	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2C-G5 (Semigloss)	MPI RIN 9.2C-G5 (Semigloss)	MPI 50	MPI 47	MPI 47	4 mils
Topcoat: Coating to match adjacent surfaces.					

Epoxy, New, uncoated Existing

Epoxy				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2E-G6 (Gloss)	MPI 50	MPI 77	MPI 77	4 mils
Topcoat: Coating to match adjacent surfaces.				

Epoxy, Existing, previously painted

Epoxy				
Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI RIN 9.2D-G6 (Gloss)	MPI 17	MPI 77	MPI 77	4 mils
Topcoat: Coating to match adjacent surfaces.				

-- End of Section --

## SECTION 09 96 00

## HIGH-PERFORMANCE COATINGS

11/14

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

MASTER PAINTERS INSTITUTE (MPI)

**MPI ASM** (2019) Architectural Painting  
Specification Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

**SSPC 7/NACE No.4** (2007) Brush-Off Blast Cleaning

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

**QPL-TNT-AP-28** (2004) Paint, Aluminum, Heat Resisting  
(1200 Degrees F)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-01 Preconstruction Submittals**

Equipment List[; G[, [\_\_\_\_]]]

**SD-03 Product Data**

Heat-Resistant Coatings[; G[, [\_\_\_\_]]]

Epoxy Coatings[; G[, [\_\_\_\_]]]

Polyurethane Coatings[; G[, [\_\_\_\_]]]

Chlorinated-Rubber Coatings[; G[, [\_\_\_\_]]]

**SD-04 Samples**

Color Chips[; G[, [\_\_\_\_]]]

**SD-07 Certificates**

Heat-Resistant Coatings[; G[, [\_\_\_\_]]]

Epoxy Coatings[; G[, [\_\_\_\_]]]

Polyurethane Coatings[; G[, [\_\_\_\_]]]

Chlorinated-Rubber Coatings[; G[, [\_\_\_\_]]]

Manufacturer's Printed Instructions[; G[, [\_\_\_\_]]]

### 1.3 QUALITY CONTROL

Comply with Master Painters Institute (MPI) Standards indicated and listed in "MPI Approved Products List." Comply with the requirements in "MPI Architectural Painting Specification Manual" before any project is started.

Submit an [equipment list](#) consisting of a list of proposed equipment to be used in performance of construction work.

Submit three [color chips 3-inch by 4-inch](#) or manufacture's pull-down of each finish color and gloss as scheduled.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver special coating materials to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Provide new and unopened containers.

Store special coating materials in tightly closed containers in a covered, well-ventilated area where they are not exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Protect water-based coatings against freezing.

Store solvents, thinners, and equipment cleaners with the same care as the coating materials with ambient temperatures continuously maintained at a minimum [45 degrees F](#).

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

Submit manufacturer's catalog data including manufacturer's name and identification. Include detailed data analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Also provide manufacturer's data concerning application, thinning, and average coverage per [gallon](#)

#### 2.1.1 [Heat-Resistant Coatings](#)

##### 2.1.1.1 [Category 1, 50 to 400 Degrees F](#)

Provide alkyd resin-based material for surface temperature coatings not exceeding [400 degrees F](#). Apply a minimum two coats of coating with a dry-film thickness of a minimum [4 mils](#).

Apply an epoxy zinc primer as a first coat conforming to [MPI ASM](#), No. 20 with the resin solids and zinc pigment not less than 80 percent of the total weight of the material.

White and color pigmented finish coats are an alkyd resin-based material

with the resin solids and pigments not less than 85 percent of the total weight of the material. Ensure pigments are heat-stable materials, formulated to colors as scheduled.

Ensure black-pigmented finish coats are an alkyd resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Provide aluminum pigmented finish coats that are an alkyd resin-based material with resin solids and pigments not less than 50 percent of the total weight of the material.

#### 2.1.1.2 Category 2, 300 to 600 Degrees F

Coatings for surface temperatures not exceeding 600 degrees F are based on modified silicone and silicone-based resins. Apply coatings in not less than two coats with a dry-film thickness of not less than 3 mils.

Provide a silicone-based resin zinc-pigmented material with the resin solids and zinc pigment for the first coat not less than 80 percent of the total weight of the material.

Apply color pigmented finish coats using silicone-based resin material with the resin solids and pigments not less than 80 percent of the material's total weight. Pigments are heat-stable materials, formulated to colors as scheduled.

Ensure black-pigmented finish coat is a silicone-based resin carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coats are a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

#### 2.1.1.3 Category 3, 600 to 800 Degrees F

Provide a modified silicone or a silicone-based material of coating for surface temperatures not exceeding 800 degrees F. Apply a minimum two coats with a dry-film thickness of a minimum 1 mils per manufacturer's recommendations.

Provide a silicone-based resin, zinc-pigmented material first coat with the resin solids and zinc pigment for the first coat not less than 80 percent of the total weight of the material.

Ensure black-pigmented finish coat is a silicone-based resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coat is a a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

#### 2.1.1.4 Category 4, 800 to 1,200 Degrees F

Provide an aluminum-pigmented, silicone-resin-based coating for surface temperatures not exceeding 1,200 degrees F conforming to QPL-TNT-AP-28, as modified.

Apply a minimum two coats with a minimum dry-film thickness of 2 mils.

Ensure the coating pigment contains a minimum 28 percent aluminum, based on the total weight of the material. Ensure coating contains a minimum of 22 percent silicone resin and a maximum of 49 percent of volatile thinners and driers based on the total weight of the material.

## 2.2 MATERIALS

### 2.2.1 Epoxy Coatings

Conform to MPI ASM, No. 116 for epoxy coatings and epoxy block filler, as modified.

Resins for finish coats are based on a polyamide-cured, epoxy-resin material. Apply finish coats with a dry-film thickness of not less than 4 mils per coat. Finish color and gloss are as indicated.

#### 2.2.1.1 Concrete Surface Coatings

Apply a [epoxy coating system in conformance with MPI ASM, No. 77] [water-based epoxy coating system in conformance with MPI ASM, No. 115] for vertical concrete surfaces. Apply an epoxy slip-resistant deck coating system in conformance with MPI ASM, No. 82. Apply a prime coat to fill concrete surface pores with a total dry-film thickness of not less than 2 mils.

#### 2.2.1.2 Masonry Surfaces Coatings

Apply a[n] [Water-Based, Light-Industrial Coating System in conformance with MPI ASM, No. 110] [Epoxy Coating System in conformance with MPI ASM, No. 77] [Water-Based Epoxy Coating System in conformance with MPI ASM, No. 115] [Polyurethane, Pigmented, Over Epoxy Coating System in conformance with MPI ASM, No. 72]. Apply a block filler to fill surface pores with a total dry-film thickness of not less than 7 mils.

#### 2.2.1.3 Ferrous and Galvanized Metal Surface Coatings

Coatings on ferrous and galvanized metal surfaces consist of a prime coat and not less than two finish coats. Comply with MPI ASM, No. 101 for an epoxy zinc primer with a metallic-zinc pigment for the substrate to be coated and the end use of the coated surface. Ensure resin solids and zinc pigment are not less than 80 percent of the total weight of the coating material. Apply prime coat with a total dry-film thickness of not less than 4 mils. Provide an epoxy-based finished coat as specified.

#### 2.2.1.4 Aluminum Surface Coatings

Apply an Epoxy Coating System in conformance with MPI ASM, No. 80 and MPI ASM, No. 77. Apply a prime coat with a total dry-film thickness of not less than 4 mils.

### 2.2.2 Polyurethane Coatings

Ensure polyurethane coatings conform to MPI ASM for each substrate indicated.

Resins for finish coats are based on a two-part, prepolymer,



catalytic-cured, polyurethane material. Apply catalytic-cured coatings with a total dry-film thickness of not less than 10 mils per coat. Indicate finish color and gloss on the schedules.

#### 2.2.2.1 Concrete Surface Coatings

Apply a [polyurethane, pigmented coating system in conformance with MPI ASM, No. 72 and MPI ASM, No. 80] [Polyurethane, Clear, Two-Component Coating System in conformance with MPI ASM, No. 78]. Ensure the prime coat fills surface pores with a total dry-film thickness of not less than 2 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.2 Masonry Surface Coatings

Apply a polyurethane, clear, two-component coating system in conformance with MPI ASM, No. 78. Apply block filler to fill surface pores with a total dry-film thickness of not less than 7 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.3 Ferrous and Galvanized Metal Surface Coatings

Apply a [polyurethane, pigmented coating system in conformance with MPI ASM, No. 72, MPI ASM, No. 77, and MPI ASM, No. 101] [high-performance architectural latex coating system in conformance with MPI ASM, No. 134, No. 138, and MPI ASM, No. 140]. Apply a prime coat with a dry-film thickness of not less than 2 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.4 Aluminum Surface Coatings

Apply a water base, light industrial coating system in conformance with [ MPI ASM, No. 95] [MPI ASM, No. 77 and MPI ASM, No. 80 for epoxy coating] [ MPI ASM, No. 80 for polyurethane] coats on aluminum surfaces. Prime coat is a polyurethane-resin material as recommended by the coating manufacturer for the substrate to be coated. Apply prime coat with a dry-film thickness of not less than 2 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.2.5 Wood Surface Coatings

Apply a [pigmented polyurethane coating in conformance with MPI ASM, No. 72] [clear polyurethane two-component coating in conformance with MPI ASM, No. 13 and MPI ASM, No. 78]. Apply prime coat with a dry-film thickness of not less than 5 mils. Finish coats are polyurethane-based material as specified.

#### 2.2.3 Chlorinated-Rubber Coatings

Base resins for finish coats on a modified, chlorinated-rubber, phenolic-resin material. Ensure coating materials contain not less than 20 percent chlorinated rubber resin, based on the total weight of the material. Apply finish coats with a dry-film thickness of not less than 3 mils per coat. Finish coating color is as indicated.

##### 2.2.3.1 Concrete Surface Coatings

Apply a minimum three coats on concrete surfaces. Provide prime coats with a chlorinated-rubber resin material as recommended by the coating

manufacturer for the substrate to be coated and the end use of the coated surfaces. Ensure the prime coat fills concrete surface pores with a total film thickness of not less than 2 mils. Finish coats are chlorinated-rubber-based coatings as specified.

#### 2.2.3.2 Masonry Surface Coatings

Apply a minimum of two finish coats of masonry block filler on masonry surfaces. Block fillers are based on an epoxy-ester resin material as recommended by the coating manufacturer for the substrate and end use of the coated surface. Fill surface pores with block filler at a total film thickness of not less than 7 mils. Finish coats are chlorinated-rubber-based coatings as specified.

#### 2.2.3.3 Ferrous and Galvanized Metal Surface Coatings

Apply a minimum two coats of high performance architectural latex coating in conformance with MPI ASM, No. 79 on ferrous and galvanized metal surfaces. Apply prime coat with a dry-film thickness of not less than 3 mils. Finish coats are chlorinated rubber-based coatings as specified.

#### 2.2.3.4 Aluminum Surface Coatings

Apply a minimum three coats of quick drying primer for aluminum surfaces. Ensure prime coats conform to MPI ASM, No. 80 for aluminum coating system.

### PART 3 EXECUTION

#### 3.1 PREPARATION

##### 3.1.1 Surface Preparation

Protect adjacent materials and equipment against damage from spillage, dripping, and spatter of coating materials. Leave clean building materials and equipment with all damaged surfaces corrected. Provide "WET PAINT" signs to indicate newly painted surfaces.

Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Contracting Officer, and leave in an undamaged condition. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

Provide forced ventilation for interior spaces during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Provide fire extinguishers of the required quantity and correct type to combat flammable liquid fires.

Dispose of rags that are used to wipe up coating materials, solvents, and thinners by drenching with water and placing them in a covered metal container

##### 3.1.2 Cleaning

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Clean application equipment promptly and thoroughly with a suitable solvent after each use and stored in a clean, covered, well-ventilated container.

### 3.1.3 Concrete Surfaces

Conform to **MPI ASM** for substrates indicated. Remove plates, machined surfaces, and similar items already in place that are not to be coated. Provide surface-applied protection before surface preparation and coating where removal is impractical or impossible. After completing coating operations, reinstall items that were removed.

Clean dirt, oil, grease, and incompatible paints from substrates to ensure bonding. Coordination of shop-applied prime coats with high-performance coatings is critical. Remove incompatible primers. Reprime substrate with compatible primers as required to produce coating systems indicated.

#### 3.1.3.1 Concrete Substrates

Remove release agents, curing compounds, efflorescence, and chalk. Maximum allowable moisture content of concrete is 12 percent. Measure moisture content with an electronic moisture meter.

Clean surfaces with pressurized water. Use pressure range of [ 1500 to 4000 psi at 6 inch to 12 inch] [ 4000 to 10,000 psi].

Comply with **SSPC 7/NACE No.4** (NACE No. 4), "Brush-Off Blast Cleaning" for abrasive cleaning.

#### 3.1.3.2 Clay Masonry Substrates

Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.

Clean surfaces with pressurized water. Use pressure range of [ 100 to 600 psi] [ 1500 to 4000 psi] at 6 inch to 12 inch.

#### 3.1.3.3 Steel Substrates

Remove rust and loose mill scale. Clean using methods recommended in writing by coating manufacturer. Conform to **SSPC 7/NACE No.4** for blast cleaning.

#### 3.1.3.4 Galvanized-Metal Substrates

Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

#### 3.1.3.5 Aluminum Substrates

Remove surface oxidation.

#### 3.1.3.6 Wood Substrates

Wood substrates that contain small surface knots are prepped by sanding surfaces smooth. Apply a thin coat of knot sealer before applying an interior latex-based wood primer. Prime edges, ends, faces, undersides, and back sides of wood. After priming, fill holes and crevices to the finished surface with putty or plastic wood filler. After finished surface is dry, smooth surface by sanding, for a finished product.

#### 3.1.4 Coating Material Preparation

Mix and prepare coating materials in accordance with the coating [manufacturer's printed instructions](#) for applying the particular material and coat. Keep materials which are not in actual use in closed containers.

Coating materials that have been mixed with an automatic shaker are allowed to stand to let air bubbles escape, then given a final hand mixing before application. Stir materials so as to produce a mixture of uniform density. Stir at frequent intervals during application to prevent skinning. Do not stir film which may form on the surface of the material. Remove film and strain, if necessary.

##### 3.1.4.1 Thinning

Thinning is done in accordance with coating manufacturer's printed directions for the particular material and coat.

##### 3.1.4.2 Tinting

Ensure prime and intermediate coats of paint are slightly different tints from the finish coat to facilitate identification of each coat. Tinting is done by the coating manufacturer and clearly identified as to color and coat.

#### 3.2 APPLICATION

Do not perform exterior painting in damp or rainy weather. Interior painting is not allowed until the building is enclosed and has thoroughly dried out. Painting is not allowed below [50 degrees F](#) or above [95 degrees F](#). Apply paint in accordance with the coating manufacturer's recommendations, and as specified.

Ensure coating application is done by skilled applicators. Apply coatings to clean and properly prepared surfaces. Apply coatings with clean, high-quality application equipment. Allow sufficient time between coats to ensure complete drying and curing. Sand and dust surfaces between coatings, as required, to produce a surface free of visible defects. Lightly sand high gloss coatings and clear finishes between coats to ensure bond of following coats.

Apply coats to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections are not acceptable. Remove defective coating applications and re-coat as directed.

Ensure coating lines such as wainscots are sharp, true, and well-defined. Tape may be used to establish coating lines, providing tape is removed before ragging or sawtooth edges form.

Ensure surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, meet the dry-film thickness not less than

specified.

### 3.2.1 Brush Application

Use clean, proper size brushes for high-quality application of the specified coating materials. Brush out slow-dry coatings. Brush out quick-dry coatings only enough to spread out evenly.

### 3.2.2 Roller Application

Use clean roller covers of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Ensure roller application is equivalent in all respects to the same coats applied by high-quality brush application.

### 3.2.3 Spray Application

[ Do not allow spray application of coatings. Spray application equipment is limited to airless-spray equipment and electrostatic-spray equipment. Ensure equipment is clean and operated by workmen skilled in high quality application of coating materials.

] [Spray application of coatings is limited to finish coats on metal frame works, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Apply spray coatings as equivalent in all respects to the same coats applied by high quality brush application. Permit each spray coat to cure before the succeeding coat is applied. Do not double back with application equipment, for the purpose of building up film thickness of two coats in one operation.

] [Cover surfaces adjacent to sprayed areas to prevent damage from overspray, coating rebound, and spray drift.

## ] 3.3 FIELD QUALITY CONTROL

### 3.3.1 Field Test

Government may take dry-film tests from time to time on finished surfaces. Apply additional coatings to surfaces where there is less than the minimum specified dry-film thickness.

### 3.3.2 Repairing

Remove damaged and unacceptable portions of completed work and replace with new work to match adjacent surfaces at no additional cost to the Government.

-- End of Section --

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## SECTION 09 96 59

## HIGH-BUILD GLAZE COATINGS

05/11, CHG 1: 08/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

**ASTM E84** (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

## MASTER PAINTERS INSTITUTE (MPI)

**MPI 31** (2012) Varnish, Polyurethane, Moisture Cured, Gloss (MPI Gloss Level 6)

**MPI 71** (2012) Varnish, Polyurethane, Moisture Cured, Flat (MPI Gloss Level 1)

**MPI 72** (2016) Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

**SSPC SP 5/NACE No. 1** (2007) White Metal Blast Cleaning

**SSPC SP 6/NACE No. 3** (2007) Commercial Blast Cleaning

**SSPC SP 10/NACE No. 2** (2015) Near-White Blast Cleaning

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-03 Product Data****High-Build Glaze Coatings**

Submit three copies of coating manufacturer's printed product data.

**SD-04 Samples**

**High-Build Glaze Coatings; G[, [\_\_\_\_]]**

Submit color chips of standard colors.

Coating System; G[, [\_\_\_\_]]

Submit rigid panels on which the complete coating system is applied. Submit panels of the same materials as the surfaces to which the coating system is to be applied.

#### SD-06 Test Reports

Filler Material

Primers

Top Coating

#### SD-07 Certificates

Qualifications of Installer

#### SD-08 Manufacturer's Instructions

Wall Coating System

Submit instructions covering application of the wall coating system, including surface preparation, detailed application procedures, number and types of coats required, maximum and minimum application temperatures, and induction, pot life, and intercoat cure times. Safety Data Sheets (SDS) shall address all components of the paint coating system, including solvents, primers, and other hazardous materials.

### 1.3 DELIVERY, STORAGE, AND HANDLING

#### 1.3.1 Acceptance at Site

Deliver materials to the project site in original, factory-sealed containers or packages labeled with identification of contents, manufacturer's name and address, manufacturer's tradename or trademark, date of manufacture, specification number, batch number, color, instructions for use, and recommendations for protective measures against toxicity.

#### 1.3.2 Storage and Protection

Protect and store materials under cover in dry, well-ventilated areas. Keep in original tightly sealed containers or packages, and in such sequence that oldest stocks are used first. Store at temperatures between 40 and 120 degrees F. Do not use material that is more than one year old from the date of manufacturing.

### 1.4 ENVIRONMENTAL REQUIREMENTS

#### 1.4.1 Protection During Cleaning

Personnel engaged in solvent-cleaning of galvanized metal and aluminum, or cleaning concrete, masonry, or portland cement plaster with 5 to 10 percent solution of hydrochloric acid, shall wear the appropriate personal protective equipment to prevent skin and eye contact and fumes



inhalation. Ventilate all work areas properly.

#### 1.4.2 Personnel Protection During Coating Applications

Personnel painting with high-build glaze coating systems shall wear the appropriate personal protective equipment to prevent skin or eye contact or inhalation. Ensure employees use and maintain solvent-resistant, personal protective equipment for the whole body. Emergency eye wash and water supplies shall be available near the work area for emergency flushing of the eyes and body. Coating applications shall be performed only in areas with good ventilation. Smoking will not be permitted in the area where coating is being applied. Wall and room temperature at the time of coating application and curing shall be in accordance with the manufacturer's instructions.

#### 1.4.3 Protection During Application of Polyurethane Paints

Mix and apply polyurethane paints only in specifically designated areas with local exhaust ventilation and other environmental control measures as recommended on the basis of an on-site industrial hygiene survey. Supply and use air respirators in closed areas where adequate ventilation cannot be obtained.

### 1.5 QUALIFICATIONS OF INSTALLER

Installation shall be by an applicator approved by the manufacturer of the surfacing materials. Furnish a written statement from the manufacturer indicating that the installer is acceptable.

## PART 2 PRODUCTS

### 2.1 WALL COATING SYSTEM

#### 2.1.1 Filler Material

As recommended by the coating system manufacturer.

#### 2.1.2 Primers

As recommended by the coating system manufacturer.

#### 2.1.3 Top Coating

- a. High Performance Architectural Coating,  
[Epoxy-Polyamide] [Epoxy-Polyester] [Polyurethane] [, Gloss] [, Semigloss]
- b. Two component, epoxy-polyamide for interior use.
- [c. MPI 31, Single Component, Moisture-curing Urethane, clear, gloss top coat.]
- [d. MPI 71, Single Component, Moisture-curing Urethane, clear, flat top coat.]
- [e. MPI 72, Two-Component, Pigmented, gloss level 6.]

#### 2.1.4 High-Build Glaze Coatings Systems Requirements

Provide a complete coating system from a single manufacturer. The system

shall have a flame spread index of not more than 25 and a smoke developed index of not more than [50] [\_\_\_\_], when tested in accordance with ASTM E84.

## 2.2 COLORS

Top coating colors shall be [as indicated] [and] [as shown on the architectural finishes display board]. [Colors indicated by reference to manufacturer's name and designations are for color identification only and are not intended to limit selection of other manufacturer's products with similar colors.]

## 2.3 SOURCE QUALITY CONTROL

### 2.3.1 Top Coat Testing

[High Performance Architectural Coating: Abrasion resistance with 100 mg maximum loss, scrubability, resistance to heat and humidity, and impact resistance tests.]

[Epoxy-polyamide: abrasion resistance and steam resistance tests.]

[MPI 31 abrasion resistance and resistance to water tests [and, resistance to accelerated weathering test, for loss of gloss, and chalking, with continuous exposure to light and intermittent exposure to water spray].]

## PART 3 EXECUTION

### 3.1 Examination

#### 3.1.1 Verification of Surface Conditions

Before commencing work, inspect surfaces to receive coatings and report to the Contracting Officer, in writing, of unsatisfactory surfaces. Inspection shall include examining the nature and condition of surfaces before, during, and after painting application, and reporting the same on a systematic basis. Inspection shall include ensuring that manufacturer's recommended procedures are followed during each stage of surface preparation and paint application.

### 3.2 PREPARATION

#### 3.2.1 Protection

Remove, mask, or otherwise protect hardware, fixtures, accessories, and parts in contact with coated surfaces, and other parts that are factory-finished such as motors, sensing devices, thermostats. Protect adjacent surfaces to confine coatings to designated areas. Correct defects caused by installed equipment prior to finishing. Reinstall removed work after completion of each area.

#### 3.2.2 Moisture

Surfaces shall be dry to receive finishes. Measure moisture content of substrate with probe-type moisture meter implanted into backing. Moisture content shall not exceed [8] [15] percent.

#### 3.2.3 [Restoration

Prior to application of coatings, touch up and restore all substrates where

damaged or defaced.

#### ]3.2.4 Surface Preparation

Prepare surfaces in accordance with the coating manufacturer's printed instructions. Remove contaminants including splinters, mortars, rust and other products of corrosion, disintegrated coatings, and other substances that could interfere with adhesion of the coating system to the substrate.

#### 3.2.5 Additional Preparation for Specific Materials

##### 3.2.5.1 Sealants and Caulkings

Remove loose, cracked, or otherwise defective sealant materials and replace with new sealant as specified in Section 07 92 00 JOINT SEALANTS. Sealant materials shall be compatible with wall coating system materials.

##### 3.2.5.2 Foreign Substances

Remove foreign substances by water washing, steam cleaning, cleaning compounds or detergents, or other procedures.

##### 3.2.5.3 [Previously Painted or Coated Surfaces

Remove loose or scaling materials prior to application of wall coating. Repair, smooth, sand, spackle, or otherwise treat to render imperceptible in the finished work defects such as scratches, nicks, cracks, gouges, spalls, alligating, and irregularities due to partial peeling of previous paint coatings. Where impractical to satisfactorily eliminate defects by other means, remove existing coatings from the entire surface, repair surface as necessary, prime, and repaint. Completely remove coating in areas where more than 25 percent of the existing substrate material has failed.

##### ]3.2.5.4 Ferrous Metals

Prepare ferrous metals in accordance with [SSPC SP 5/NACE No. 1](#), [SSPC SP 6/NACE No.3](#), or [SSPC SP 10/NACE No. 2](#), as recommended by the manufacturer.

##### 3.2.5.5 Galvanized Metal

Clean and dry, using solvent, galvanized metal surfaces of detrimental foreign matter such as oil, grease, and other contaminants. Prior to coating application, pretreat the surface material in accordance with manufacturer's printed instructions for pretreatment compound mixing and application.

##### 3.2.5.6 Aluminum

Using solvent, clean surfaces of oils, grease, and other lubricants. Remove dirt, water-soluble chemicals, and similar surface contaminants by washing with water, or water and detergent. When detergents are used, rinse with clear water. Pretreat these surfaces prior to coating application in accordance with manufacturer's printed instructions.

##### 3.2.5.7 Concrete, Masonry, and Portland Cement Plaster

Cure new concrete and masonry surfaces a minimum of 30 days prior to

painting. Repair concrete surfaces before coating. Clean surfaces to be coated, removing dirt, fungus, grease, oil, asphalt, tar, and other foreign substances. Remove efflorescence, chalk, and similar substances from concrete, masonry, portland cement, and plaster surfaces in the following manner:

- a. Wash with a 5 to 10 percent aqueous solution of hydrochloric acid and rinse the surface with clean water and allow to dry.
- b. Free surfaces from mortar deposits and form release agents.
- c. Remove laitance from surfaces by etching with hydrochloric acid solution.
- d. Rinse the surface again with clean water and allow to dry.
- e. Sand cracked surfaces smooth and fill with filler compatible with the substrate and coating materials.
- f. Apply filler until surfaces are completely filled (pin-hole free) and smooth.
- g. Sand lightly and wipe clean.
- h. Apply the filler in [one] [two] coat[s], to a [wet] [dry] film thickness of [\_\_\_\_\_] mils [for each coat], measured with a Tooke gage or similar thickness measuring gage].

#### 3.2.5.8 Gypsum Plaster

Thoroughly dry and clean gypsum plaster before application of coatings. Remove lime deposits by sanding lightly. Sand cracked surfaces smooth; and fill with joint treatment compound compatible with plaster and coating materials. Sand lightly and wipe clean. Surfaces of plaster shall age a minimum of 30 calendar days and pass the following test: Using an electric moisture meter, when more than 8 percent moisture is indicated, surfaces are not sufficiently cured to be coated.

#### 3.2.5.9 Woodwork

Provide a surface which is dry, smooth, and free from raised grain or other imperfections. Fill nail holes, cracks, joints, crevices, and other blemishes with materials compatible with the coating materials, and sand smooth and flush with adjacent wood surfaces before application of coatings. Sand in the direction of the grain. Back-prime wood in contact with or built into concrete, masonry, or plaster as specified in Section 09 90 00 PAINTS AND COATINGS. Prime end cuts and edges. [Seal with a mixture of equal parts of shellac and alcohol or knot sealer.] [Treat as specified for defects such as knots, resins, gum, or extractives].

#### 3.2.5.10 Gypsum Wallboard

Reinforce and conceal joints of gypsum wallboard panels as specified in Section 09 29 00 GYPSUM BOARD. Apply a skim coat of gypsum plaster over the gypsum wallboard. Sand smooth, fill with joint treatment compound, sand lightly, and wipe clean surfaces prior to application of glaze coating.

### 3.3 COATING APPLICATION

Apply coating system over specified filler where applicable.

### 3.3.1 Apply Coating

After preparing surface, apply coating system directly to metal, gypsum wallboard, gypsum plaster, and previously painted surfaces in accordance with the manufacturer's instructions. Provide alkali-resistant primers for concrete, masonry, and portland cement plaster surfaces.

### 3.3.2 Thickness Test

Measure dry film thickness of coating system, excluding filler coat, with a Tooke gage or similar thickness measuring gage. Any paint damaged during thickness measurement shall be repaired to match the original.

### 3.3.3 Interior Application

Apply wall coating system in accordance with manufacturer's specifications with a spreading rate to produce a dry film thickness of [\_\_\_\_\_] mils for each of [two] [three] coats applied. Protect coated surfaces after application and during the curing periods.

### 3.3.4 Exterior Application

Mix and apply wall coating system in accordance with manufacturer's specifications with a spreading rate to produce a dry film thickness of [\_\_\_\_\_] mils for each of [two] [three] coats applied. Protect coated surfaces during curing periods.

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## SECTION 09 97 02

PAINTING: HYDRAULIC STRUCTURES  
02/20, CHG 1: 11/21

## PART 1 GENERAL

## 1.1 LUMP SUM PRICE

## 1.1.1 Painting: Hydraulic Structures

## 1.1.1.1 Payment

Payment will be made for costs associated with "Painting: Hydraulic Structures", which includes full compensation for furnishing all materials, equipment, and labor required to paint the hydraulic structures in accordance with this section.

## 1.1.1.2 Unit of Measure

Unit of measure: lump sum.

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM D153	(1984; R 2014) Specific Gravity of Pigments
ASTM D235	(2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D281	(2012; R 2016) Standard Test Method for Oil Absorption of Pigments by Spatula Rub-Out
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM D561	(1982; R 2014) Carbon Black Pigment for Paint
ASTM D740	(2011) Methyl Ethyl Ketone
ASTM D841	(2019) Standard Specification for Nitration Grade Toluene
ASTM D962	(1981; R 2014) Aluminum Powder and Paste Pigments for Paints
ASTM D1045	(2019) Standard Test Methods for Sampling and Testing Plasticizers Used in Plastics
ASTM D1152	(2006; R 2012) Methanol (Methyl Alcohol)
ASTM D1153	(2012) Methyl Isobutyl Ketone

ASTM D1200	(2010; R 2014) Viscosity by Ford Viscosity Cup
ASTM D1210	(2005; R 2014) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
ASTM D2917	(2007; R 2013) Methyl Isoamyl Ketone
ASTM D3465	(2014) Standard Test Method for Purity of Monmeric Plasticizers by Gas Chromatography
ASTM D3721	(2005; R 2011) Synthetic Red Iron Oxide Pigment
ASTM D4228	(2005; R 2017) Standard Practice for Qualification of Coating Applicators for Application of Coatings to Steel Surfaces
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4417	(2021) Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D7091	(2021) Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nondestructive Coatings Applied to Non-Ferrous Metals
ASTM E1347	(2006; R 2020) Standard Test Method for Color and Color Difference Measurement by Tristimulus (Filter) Colorimetry

## INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices
ANSI/ISEA Z358.1	(2014) American National Standard for Emergency Eyewash and Shower Equipment

## MASTER PAINTERS INSTITUTE (MPI)

MPI 9	(2016) Alkyd, Exterior Gloss (MPI Gloss Level 6)
MPI 23	(2015) Primer, Metal, Surface Tolerant
MPI 46	(2016) Undercoat, Enamel, Interior
MPI 47	(2016) Alkyd, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 48	(2016) Alkyd, Interior, Gloss (MPI Gloss



Level 6-7)

MPI 49	(2015) Alkyd, Interior, Flat (MPI Gloss Level 1)
MPI 50	(2015) Primer Sealer, Latex, Interior
MPI 51	(2016) Alkyd, Interior, (MPI Gloss Level 3)2
MPI 52	(2016) Latex, Interior, (MPI Gloss Level 3)
MPI 53	(2012) Latex, Interior, Flat (MPI Gloss Level 1)
MPI 54	(2016) Latex, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 114	(2012) Latex, Interior, Gloss (MPI Gloss Level 6)
MPI 212	(2018) Floor Coating, Thin Film, for Aircraft Maintenance Facilities

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 2003-154	(2003; 4th Ed; Supple 3) NIOSH Manual of Analytical Methods
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SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC Guide 6	(2015) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC PS 26.00	(2000; E 2004) Aluminum Pigmented Epoxy Coating System Materials Specification, Performance-Based (Type I for use over Blast Cleaned Steel and Type II for use over Hand Cleaned Steel)
SSPC Paint 16	(2006; R 2015; E 2015) Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint

SSPC Paint 20	(2019) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)
SSPC Paint 33	(2006; R 2015; E 2015) Coal Tar Mastic, Cold-Applied
SSPC Paint 38	(2006) Single-Component Moisture-Cure Weatherable Aliphatic Polyurethane Topcoat, Performance-Based
SSPC Paint 40	(2019) Zinc-Rich Moisture-Cure Polyurethane Primer, Performance-Based
SSPC Paint 41	(2008) Moisture-Cured Polyurethane Primer or Intermediate Coat, Micaceous Iron Oxide Reinforced, Performance-Based
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC QP 2	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Removal of Hazardous Coatings from Structures)
SSPC QP 3	(2010) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 5/NACE No. 1	(2007) White Metal Blast Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 16	(2010) Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE AMS-STD-595A	(2017) Colors used in Government Procurement
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual
U.S. DEPARTMENT OF DEFENSE (DOD)	
MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for

MIL-PRF-85285	(2022; Rev F) Topcoat, Aircraft and Support Equipment
U.S. GENERAL SERVICES ADMINISTRATION (GSA)	
CID A-A-3130	(Rev A) Paint (For Application to Wet Surfaces)
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.20	Access to Employee Exposure and Medical Records
29 CFR 1910.94	Ventilation
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1926.62	Lead
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards for PM10
40 CFR 50.12	National Primary and Secondary Ambient Air Quality Standards for Lead
40 CFR 58	Ambient Air Quality Surveillance
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 117	Determination of Reportable Quantities for Hazardous Substances
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.22	Number of Copies
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
49 CFR 171	General Information, Regulations, and Definitions

### 1.3 SAFETY, HEALTH, AND ENVIRONMENTAL REQUIREMENTS

Perform work in accordance with all applicable health, safety, and environmental requirements as well as EM 385-1-1. Submit matters of interpretation of these requirements to the Contracting Officer for resolution before starting work. If no clarifications are sought, then the submittal is not necessary. Where the regulations conflict, the most stringent requirements apply. This paragraph supplements the health, safety, and environmental requirements of EM 385-1-1.

#### 1.3.1 Safety

Submit an Accident Prevention Plan in accordance with the requirements of Section 01 of EM 385-1-1, including, but not limited to, each of the topic areas listed in Appendix A therein and the specified requirements. Develop each topic in a concise manner to include management and operational aspects. Submit a Ventilation Assessment Plan complying with all applicable safety standards.

##### 1.3.1.1 Abrasive Blasting

For abrasive blasting comply with the requirements in Section 06.I of EM 385-1-1. In addition to the requirements in Section 20 of EM 385-1-1, use hoses and hose connections of a type to prevent shock from static electricity. Join hose lengths together by approved couplings of a material and type designed to prevent erosion and weakening of the couplings. The couplings and nozzle attachments must fit on the outside of the hose and be designed to prevent accidental disengagement.

##### 1.3.1.2 Workers Other Than Blasters

Protect workers, other than blasting operators working in close proximity to abrasive blasting operations. Use MSHA/NIOSH-approved half-face or full-face air purifying respirators equipped with high-efficiency particulate air (HEPA) filters and eye protection meeting ANSI/ISEA Z87.1. Use hearing protectors (ear plugs and/or ear muffs) providing a noise reduction rating of at least 20 dBA or as needed to provide adequate protection. Provide personal protective equipment where required by 29 CFR 1910.146 and in accordance with 29 CFR 1910, Subpart I.

##### 1.3.1.3 Cleaning Before and After Abrasive Blasting

Cleaning with compressed air must be in accordance with Section 20.B.5 of EM 385-1-1 and personnel protected as specified in 29 CFR 1910.134. When cleaning with solvents, provide ventilation where required by 29 CFR 1910.146 or where the concentration of solvent vapors exceeds 10 percent of the Lower Explosive Limit (LEL). Ventilation must be in accordance with 29 CFR 1910.94, paragraph (c) (5).

##### 1.3.1.4 Pretreatment of Metals and Concrete with Acids

Personnel must be protected in accordance with 29 CFR 1910, Subpart I. In addition to the requirements of Section 05 of EM 385-1-1, provide an eyewash in accordance with ANSI/ISEA Z358.1, paragraph (6).

##### 1.3.1.5 Paint Mixing

Provide local exhaust ventilation in the area where coatings are mixed.

This ventilation system must be capable of providing at least 100 linear fpm of capture velocity in the mixing zone. Avoid exposure of skin and eyes by wearing appropriate chemically resistant gloves, safety goggles, and face shields meeting the requirements of ANSI/ISEA Z87.1. Provide a personal eyewash unit within close proximity to the mixing operation in accordance with ANSI/ISEA Z358.1, paragraph (9). All powered mixing equipment must be either pneumatic or double insulated (intrinsically safe), in order to guard against fire or explosion. Individuals who have a history of, or develop a sensitivity to epoxy or polyurethane resin systems, must not conduct work tasks or otherwise be exposed to such chemicals.

#### 1.3.1.6 Confined Spaces

When using solvent-based paint in confined spaces, prepare a Confined Spaces Plan. Provide ventilation to exchange air in the space at a minimum rate of 5,000 cubic feet per minute per spray gun in operation. It may be necessary to install both a mechanical supply and exhaust ventilation system to effect adequate air changes within the confined space. Locate and affix all air-moving devices to an opening of the confined space in a manner assuring that the airflow is not restricted or short circuited and is supplied in the proper direction. A suitable means of egress must be maintained at all times. Continue ventilation after completion of painting and through the drying phase of the operation. If the ventilation system fails or the concentration of volatiles exceeds 10 percent of the LEL (except in the zone immediately adjacent to the spray nozzle), stop painting and evacuate spaces until adequate ventilation is provided. Provide an audible alarm that signals system failure as an integral part of the ventilation system. Check the effectiveness of the ventilation by using ventilation smoke tubes and making frequent oxygen and combustible gas readings during painting operations. Exhaust ducts must discharge clear of the working areas and away from possible sources of ignition. Submit detailed written standard operating procedures for confined spaces in accordance with 29 CFR 1910.146 and EM 385-1-1, Section 6H, Section 34. The procedures must include:

- a. Certificates of calibration for all testing and monitoring equipment. The certificates of calibration must include: type of equipment, model number, date of calibration, firm conducting calibration, and signature of individual certifying calibration.
- b. Methods of inspection of personal protective equipment prior to use.
- c. Engineering controls and other work practices designed to reduce airborne hazardous chemical exposures to a minimum.
- d. Specification of the design and installation of ventilation systems which provide adequate oxygen content and provide for the dilution of paint solvent vapor, lead, and other toxic particulates within the confined space. Procedures must also include plans to evaluate the adequacy of air flow patterns.

#### 1.3.1.7 Paint Spraying

Submit a comprehensive written Respiratory Protection Plan in accordance with 29 CFR 1910.134, 29 CFR 1926.62, and EM 385-1-1, Section 05.G. During all spray painting operations, spray painters must use approved SCBA or SAR (air line) respirators, unless valid air sampling has demonstrated contaminant levels to be consistently within concentrations compatible with

the Assigned Protection Factor (APF) of an air-purifying respirator. Persons with facial hair that may interfere with the seal or valve function of a half or full facepiece style respirator may wear a hood or helmet respirator provided the APF is sufficient for the exposure. Air-purifying chemical cartridge/canister respirators that have a particulate prefilter and are suitable for the specific type(s) of gas/vapor and particulate contaminant(s) may be used for nonconfined space painting, mixing, and solvent cleaning. These respirators may be used provided the measured or anticipated concentration of the contaminant(s) in the breathing zone of the exposed worker does not exceed the APF for the respirator and the gas/vapor has good warning properties or the respirator assembly is equipped with a NIOSH-approved end of service life indicator for the gas(es)/vapor anticipated or encountered. Where paint contains toxic elements that may become airborne during painting in nonconfined spaces, air-purifying half- and full-facepiece respirators or powered air-purifying respirators equipped with appropriate gas vapor cartridges, in combination with a high-efficiency filter, or an appropriate canister incorporating a high-efficiency filter, must be used.

#### 1.3.1.8 Explosion Proof Equipment

Electrical wiring, lights, and other equipment located in the paint spraying areas must be of the explosion proof type designed for operation in Class I, Division 1, Group D, hazardous locations as required by the [NFPA 70](#). Electrical wiring, motors, and other equipment, outside of but within [20 feet](#) of any spraying area, must not spark and must conform to the provisions for Class I, Division 2, Group D, hazardous locations. Electric motors used to drive exhaust fans must not be placed inside spraying areas or ducts. Fan blades and portable air ducts must be constructed of nonferrous materials. Properly maintain and ground motors and associated control equipment. Electrically bond and ground the metallic parts of all air-moving devices, spray guns, connecting tubing, and duct work.

#### 1.3.1.9 Further Precautions

- a. Workers must wear nonsparking safety shoes.
- b. Solvent drums taken into the spraying area must be grounded. Maintain metallic bonding between containers and drums when materials are being transferred.
- c. Inspect insulation on all power and lighting cables to ensure that the insulation is in excellent working condition and is free of all cracks and worn spots. Ensure that no connections are within [50 feet](#) of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing.

#### 1.3.1.10 Ignition Sources

Ignition sources, including lighted cigarettes, cigars, pipes, matches, or cigarette lighters, and electronic smoking devices are prohibited in areas of solvent cleaning, paint storage, paint mixing, or paint application.

#### 1.3.2 Health

Prepare and submit a [Medical Surveillance Plan](#) and a statement from the examining physician indicating the name of each employee evaluated and any limitations which will preclude the employee from performing the work required. The statement must include the date of the medical evaluation,

the physician's name, signature, and telephone number.

#### 1.3.2.1 Air Monitoring

Prepare and submit an [Air Monitoring Test Plan](#). Perform air sampling and testing as needed to assure that workers are not exposed to contaminants above the permissible exposure limit. In addition, provide the Contracting Officer with a copy of the [Air Monitoring Test Report](#) from the laboratory within five working days of the sampling date, including records of air monitoring plans and tests performed. Submit reports as soon as information is available. Also provide results from direct-reading instrumentation on the same day the samples are collected. Prepare and submit an [Airborne Sampling Plan](#) detailing the [NIOSH 2003-154](#), Factory Mutual, or Underwriters Laboratories approved equipment, equipment calibration procedures, sampling methods, sampling to be performed, and analytical procedures to be used based on the type of work to be performed and anticipated toxic contaminants to be generated. Include the name of the accredited laboratory, listed by the American Industrial Hygiene Association (AIHA), that will be used to conduct the analysis of any collected air samples.

#### 1.3.2.2 Medical Status

Prior to the start of work, and annually thereafter, submit a Report of [Medical Status Records](#). This report will certify that Medical Status Records, in accordance with the requirements below are maintained for all required employees. The Contractor-maintained Medical Status Reports will document the medical evaluation of all employees working with or around paint systems, thinners, blast media, those required to wear respiratory protective equipment, and those who will be exposed to high noise levels for the particular type of exposure they may encounter. The Contractor-maintained Records must include the employee's name, the tests performed and the name of the physician responsible for performing the tests, and a physician's statement that medical status would permit specific task performance. Maintain medical records as required by [29 CFR 1910.20](#). The evaluation must include:

- a. Audiometric testing and evaluation of employees who will work in a noise environment with a time weighted average greater than or equal to 85 dBA.
- b. Vision screening of employees who will require eye protection (employees who use full-facepiece respirators cannot wear contact lenses).
- c. Medical evaluation of employees who will be required to wear respiratory protection must include, but is not limited to, the following:
  - (1) Medical history including, but not limited to, alcohol use, with emphasis on liver, kidney, and pulmonary systems, and sensitivity to chemicals to be used on the job.
  - (2) General physical examination with emphasis on liver, kidney, and pulmonary system.
  - (3) Determination of the employee's physical and psychological ability to wear respiratory protective equipment and to perform job-related tasks.

- (4) Determination of baseline values of biological indices for later comparison to changes associated with exposure to paint systems and thinners or blast media, which include: liver function tests to include SGOT, SGPT, GGPT, alkaline phosphates, bilirubin, complete urinalysis, EKG (employees over age 40), blood urea nitrogen (bun), serum creatinine, pulmonary function test, FVC, and FEV, chest x-ray (if medically indicated), blood lead and ZPP (for individuals where it is known there will be an exposure to materials containing lead), other criteria that may be deemed necessary by the Contractor's physician.
- (5) For lead-based paint removal, prepare and submit a [Worker Protection Plan](#) in accordance with the requirements of [29 CFR 1926.62](#), addressing all necessary aspects of worker protection. The plan must include medical screening, activities emitting lead, means to achieve compliance, alternative technologies considered, air monitoring program, implementation schedule, work practice program, administrative controls, multi-Contractor site arrangements, and jobsite inspections.

#### 1.3.2.3 Change in Medical Status

Any employee whose medical status has changed negatively due to work related chemical and/or physical agent exposure while working with or around paint systems and thinners, blast media, or other chemicals must be evaluated by a physician, and obtain a physician's statement as described in paragraph MEDICAL STATUS prior to allowing the employee to return to those work tasks. Maintain Change in Medical Status Records detailing any negative changes in employee medical status and the results of the physician's reevaluation statement. Submit a [Change in Medical Status Report](#) detailing the negative changes in medical status and a summary of the physician's reevaluation without including personal information of the impacted employee.

#### 1.3.3 Environmental Protection

In addition to the requirements of Section [01 57 19](#) TEMPORARY ENVIRONMENTAL CONTROLS, prepare an [Environmental Protection Plan](#) incorporating the submittals for Water Quality Plan, Containment Plan, Waste Disposal Plan, Soil Quality Plan, TSP Monitoring Plan, PM-10 Monitoring Plan, and Visible Emissions Monitoring Plan. The submitted plan must also address all aspects of establishing and demarcating regulated areas, ventilation/containment system performance verification, and reporting of accidental releases. Comply with the following environmental protection criteria.

##### 1.3.3.1 Waste Classification, Handling, and Disposal

Prepare and submit a [Waste Disposal Plan](#) in accordance with the requirements of [40 CFR 261](#) and [40 CFR 262](#) including classification and handling. The Contractor is responsible for assuring the proper disposal of all hazardous and nonhazardous waste generated during the project. [Regardless of the results of 40 CFR 261 App II, Mtd 1311](#), all waste generated from abrasive blasting, lead-containing paints with recyclable steel or iron abrasives must be either disposed of as a hazardous waste or be stabilized with proprietary pre-blast additives. Where stabilization is preferred, employ a proprietary blast additive, that has been blended with the blast media prior to use. Place hazardous waste in properly



labeled, closed containers shielded adequately to prevent dispersion of the waste by wind or water. Any evidence of improper storage is cause for immediate shutdown of the project until corrective action is taken. Store nonhazardous waste in closed containers separate from hazardous waste storage areas. Transport all hazardous waste by a licensed transporter in accordance with 40 CFR 263 and 49 CFR 171, Subchapter C. Transport all nonhazardous waste in accordance with local regulations regarding waste transportation. In addition to the number of copies required by 40 CFR 262.22, supply one copy of each Waste Manifest to the Contracting Officer prior to transportation.

#### 1.3.3.2 Containment

Prepare a Containment Plan for containing debris generated during paint removal operations. Include drawings, load-bearing capacity calculations, and wind load calculations. When the design is such that the spent abrasive is allowed to accumulate in quantities greater than 1,000 pounds, and/or impart a significant wind load on the structure, have the drawings approved by a registered structural engineer. The drawings and calculations must be stamped with the engineer's seal. Also identify the type and placement of water booms, methods for anchoring the booms, and the procedures for removing debris. Contain debris generated during paint removal operations in accordance with the requirements of SSPC Guide 6, Class [\_\_\_\_]. Where required, verify the containment air pressure [by instrument] [visually].

#### 1.3.3.3 Visible Emissions Monitoring

Prepare a Visible Emissions Monitoring Plan including the provisions for halting work and correcting the containment in the event unacceptable emissions are observed. General statements must not be used; specific methods, procedures, and details are required. Measure the time of emissions in accordance with 40 CFR 60, App A, Mtd 22. Monitor visible emissions for not less than 15 minutes of every hour. Calculate visible emissions for each hour by extrapolation. Visible emissions must not extend greater than 150 feet in any direction horizontal from the containment. Visible emissions must not be observed in the area of any sensitive receptor. If such emissions occur shut down the job immediately and take corrective action. Notify the foreman whenever visible emissions exceed [40] [200] seconds in a 1 hour period. Whenever visible emissions exceed [75] [300] seconds in a 2 hour period notify the foreman, shut down the job, and take corrective action. If the total observed visible emissions from the containment exceeds [1] [5] percent of the work day, shut down the job and take corrective action to prevent such an occurrence. Document each time that the work is halted due to a violation of the visible emissions criteria. Documentation must include the cause for shutdown and the corrective action taken to resolve the problem.

#### 1.3.3.4 PM-10 Monitoring

Prepare and submit a PM-10 Monitoring Plan for monitoring emissions of particulate matter 10 microns or less in size (PM-10) in compliance with the requirements of EPA regulation 40 CFR 50.6 and this paragraph. The plan must also include provisions for halting work and correcting the containment in the event unacceptable emissions occur. Position the air monitoring equipment in accordance with 40 CFR 58, App E, Subpart (8). In addition, a minimum of two PM-10 monitors must be used at the project site, one downwind from the project and one in the area of greatest public access (e.g., playground, school yard, or homeowner's yard). When the project is

in an area where there are critical receptors nearby, monitoring must be conducted throughout the entire period that abrasive blasting and cleanup operations are performed. Otherwise, perform monitoring 4 of the first 8 days and on a regular basis thereafter for a sum total of 25 percent of the time surface preparation and debris cleanup are performed. If air quality regulatory limits are not met, take corrective actions and immediately repeat air monitoring. Conduct the preproject PM-10 monitoring a minimum of 2 weeks prior to the beginning of the project and continue for a minimum of 3 days to establish background levels. Submit a [PM-10 Test Report](#) to the Contracting Officer within 48 hours, that includes:

- a. Name and location of jobsite.
- b. Date of monitoring.
- c. Time of monitoring (i.e., time monitoring begins and ends each day).
- d. Identification and serial number of monitoring units.
- e. Drawing showing specific location of monitoring units.
- f. Drawing showing specific location of paint removal operation and the method of removal or work activity being performed.
- g. Wind direction and velocity.
- h. A flow chart verifying the rate of air flow across the filter throughout the sampling period.
- i. Name and address of laboratory.
- j. Laboratory test procedure.
- k. Laboratory test results.
- l. Signatures of field and laboratory technicians conducting the work.

#### 1.3.3.5 TSP Monitoring

Prepare a [TSP Monitoring Plan](#) for monitoring emissions of Total Suspended Particulates (TSP) in compliance with the requirements of EPA regulation [40 CFR 50.12](#) and this paragraph. The plan must include provisions for halting work and correcting the containment in the event unacceptable emissions occur. Position the air monitoring equipment in accordance with [40 CFR 58](#), App E, Subpart (8). A minimum of two TSP monitors must be used at the project site, one downwind from the project and one in the area of greatest public access (e.g. playground, school yard, or homeowner's yard). When the project is in an area where there are critical receptors nearby, TSP-lead monitoring must be conducted throughout the entire period that abrasive blasting and cleanup operations are performed. Otherwise, perform monitoring 4 of the first 8 days and on a regular basis thereafter for a sum total of 25 percent of the time surface preparation and debris cleanup are performed. If air quality regulatory limits are not met, require air monitoring to be repeated immediately after corrective actions have been taken. Also conduct preproject TSP monitoring. Conduct the preproject TSP monitoring a minimum of 2 weeks prior to the beginning of the project and continue the monitoring for a minimum of 3 days to establish background levels. Submit a [TSP Test Report](#) to the Contracting Officer within 48 hours including:

- a. Name and location of jobsite.
- b. Date of monitoring.
- c. Time of monitoring (i.e., time monitoring begins and ends each day).
- d. Identification and serial number of monitoring units.
- e. Drawing showing specific location of monitoring units.
- f. Drawing showing specific location of paint removal operation and the method of removal or work activity being performed.
- g. Wind direction and velocity.
- h. A flow chart verifying the rate of air flow across the filter throughout the sampling period.
- i. Name and address of laboratory.
- j. Laboratory test procedure.
- k. Laboratory test results.
- l. Signatures of field and laboratory technicians conducting the work.

#### 1.3.3.6 Water Quality

Prepare a [Water Quality Plan](#) for all job sites where lead-containing or other hazardous paint will be removed, including provisions for halting work if spills or emissions are observed entering into bodies of water or found in areas where storm water runoff could carry the debris into bodies of water or storm sewers. The plan must also address cleanup and reporting procedures. Conduct operations in such a manner that lead-containing and other hazardous paint debris do not contaminate the water and so that NPDES permits in accordance with EPA regulation [40 CFR 122](#) are not required for the project. Any release of lead paint debris into the waterways having a reportable quantity of hazardous substance pursuant to Section 311 of the Clean Water Act, must be reported to the EPA in accordance with [40 CFR 117](#) and [40 CFR 355](#). The plan must require the thorough documentation of any release or spill that carries into waterways or storm sewers. Include the time and location of the release, amount of material released, actions taken to clean up the debris, amount of debris recovered, and corrective action taken to avoid a reoccurrence. Also report releases to the Coast Guard and other state and local authorities as appropriate. If the release is equivalent to **10 pounds** or more of lead-containing material in a 24-hour period, it is considered to be a reportable quantity under CERCLA. Comply with [40 CFR 302](#).

#### 1.3.3.7 Soil Quality

Prepare a [Soil Quality Plan](#) for all job sites where lead-containing or other hazardous paint will be removed. The plan must include provisions for halting the work should soil contamination occur, correcting the deficiencies responsible for the contamination, and provide procedures for removing and replacing contaminated soil. Establish and implement practices and procedures for preventing contamination of the soil from the removal of lead-containing or other hazardous paints. Unless otherwise

directed by the Contracting Officer, soil is considered to have been contaminated by the Contractor's operation if an increase in the total lead content of 100 PPM or greater over background levels occurs. For purposes of computing the increase compute the mean background levels and the mean post-removal levels. The 100 PPM criteria is met if the difference between the means is less than 100 PPM plus the 95 percent confidence limit. Conduct soil sampling and testing prior to the beginning of the project and after the project is completed. Interim testing may also be performed in the event the Contractor or Contracting Officer wants to confirm that the containment system and work practices continue to provide satisfactory protection of the soil. Unless otherwise directed by the Contracting Officer, the following minimum test locations must be selected for soil analysis. Select two locations beneath or immediately adjacent to the structure being prepared. Take additional samples within 100 feet in each direction of the project (i.e., N, S, E, W) in which soil is present. The number of soil sample locations must be sufficient to adequately characterize the soil contaminant levels within and around the project area. Collect five composite samples at each location. Each of the five samples must be comprised of five individual plugs of soil combined in a single bag. Use the following procedure to collect the composite samples:

- a. Place a 1-square foot template at each location.
- b. Remove a sample of soil 3/4 inch in diameter and 1/2 inch in depth at the center of the template and at each of the four corners. Place the five soil plugs into a single bag. This represents one of the three samples to be removed at a given location.
- c. Move the template 1 inch in any direction and repeat the process to collect the second sample. Place all plugs in a separate bag. Move the template 1 inch farther to collect the third sample.
- d. Identify each sample bag with the date, specific location of the sample, name and signature of the sampling technician, and complete chain of custody records.
- e. It is critical that the specific location of each sample be thoroughly measured and documented as the final project testing (and any interim testing) must be sampled in the precise locations.

Analyze three samples collected at each location. One of the remaining two samples is to be maintained by the Contractor for the duration of the project and the other by the Contracting Officer in the event reanalysis is required. Analyze lead-containing samples in accordance with EPA testing guidance as published in 40 CFR 261, App III, by a laboratory listed by the American Industrial Hygiene Association (AIHA) as being proficient in conducting the test. Note that if it is determined that contamination of the soil has occurred as a result of the paint removal operations, TCLP testing must be employed to determine if the soil must be handled and disposed of as a hazardous waste. The initial sampling of the soil for total lead content does not establish whether the soil will be considered hazardous by TCLP testing. As a result, at the Contractor's option, additional prework soil samples may be removed (minimum of 105 grams is required for a single test at each site) to conduct TCLP testing to establish whether the soil would be classified as hazardous prior to project startup. In the event that there is a release of lead paint debris onto the soil and if the release is 10 pounds or more of lead-containing material in a 24-hour period, it is considered to be a reportable quantity under CERCLA. Comply with 40 CFR 302. Thoroughly document the occurrence

of any spills of lead debris into the soil. The documentation must include the time and location of the release, amount of material released, actions taken to clean up the debris, amount of debris reclaimed, and corrective action taken to avoid a recurrence. Provide the documentation to the Contracting Officer including the [Soil Quality Test Report](#) with results of the prework and post work soil quality tests.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

Safety, Health, and Environmental Requirements; G[, [\_\_\_\_\_]]

Accident Prevention Plan; G[, [\_\_\_\_\_]]

Confined Spaces Plan; G[, [\_\_\_\_\_]]

Respiratory Protection Plan; G[, [\_\_\_\_\_]]

Airborne Sampling Plan; G[, [\_\_\_\_\_]]

Ventilation Assessment Plan; G[, [\_\_\_\_\_]]

Medical Surveillance Plan; G[, [\_\_\_\_\_]]

Worker Protection Plan; G[, [\_\_\_\_\_]]

Environmental Protection Plan; G[, [\_\_\_\_\_]]

Waste Manifest

Waste Disposal Plan; G[, [\_\_\_\_\_]]

Containment Plan; G[, [\_\_\_\_\_]]

Visible Emissions Monitoring Plan; G[, [\_\_\_\_\_]]

PM-10 Monitoring Plan; G[, [\_\_\_\_\_]]

TSP Monitoring Plan; G[, [\_\_\_\_\_]]

Water Quality Plan; G[, [\_\_\_\_\_]]

Soil Quality Plan; G[, [\_\_\_\_\_]]

##### SD-03 Product Data

Manufacturer's Safety Data Sheet; G[, [\_\_\_\_\_]]

##### SD-04 Samples

Product Samples; G[, [\_\_\_\_\_]]

Special Paint Formulas; G[, [\_\_\_\_\_]]

Solvent and Thinners; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

PM-10 Test Report

TSP Test Report

Soil Quality Test Report

Inspection Reports

Medical Status Records

Change in Medical Status Report

Air Monitoring Test Plan; G[, [\_\_\_\_\_]]

Air Monitoring Test Report

#### SD-07 Certificates

Certified EHS Professional

Certified Lead Laboratory

SSPC [QP 1][QP-2][QP-3] Certificate; G[, [\_\_\_\_\_]]

Qualified Hazardous Paint Removal Contractor; G[, [\_\_\_\_\_]]

Coating Thickness Gage Qualification

Qualified Coating Applicator; G[, [\_\_\_\_\_]]

### 1.5 QUALIFICATIONS

Qualifications and experience must comply with the following.

#### 1.5.1 Certified Environmental, Health, and Safety (EHS) Professionals

Provide a certificate for each **Certified EHS Professional**; submit qualifications and experience of qualified and competent persons employed to provide preconstruction and onsite environmental, safety, and health services. Obtain acceptance of this submission prior to the submission of other required environmental, safety, and health submittal items. Utilize a qualified and competent person as defined in **EM 385-1-1**, Section 01 to develop the required safety and health submittal and to provide onsite safety and health services during the contract period. The person must be a Certified Industrial Hygienist (CIH), an Industrial Hygienist (IH), or a Certified Safety Professional (CSP) with a minimum of 3 years of demonstrated experience in similar related work. The CIH, IH, or CSP may utilize other qualified and competent persons, as defined in **EM 385-1-1**, to conduct on-site safety and health activities as long as these persons have a minimum of 2 years of demonstrated experience in similar related work and are under the direct supervision of the CIH, IH, or CSP. **For lead containing jobsites, the competent and qualified person must have**

successfully completed an EPA or state accredited lead-based paint abatement Supervisor course specific to the work to be performed and possess current and valid state and/or local government certification, as required.

#### 1.5.2 Certified Lead Laboratory

Provide documentation which includes the name, address, and telephone number of the laboratories to be providing services. In addition, the documentation must indicate that each laboratory is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that each is rated proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT) and will document the date of current accreditation. Certification must include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Submit a certificate for the [Certified Lead Laboratory](#).

#### [1.5.3 Qualified Painting Contractor

The Painting Contractor must be a certified [SSPC QP 1](#) Painting Contractor. Submit a copy of the applicable [SSPC \[QP-1\] \[QP-2\] \[QP-3\] Certificate](#). The contractor must have been certified prior to award of this contract and must remain certified for the duration of this contract. Certifications scheduled to expire during the contract performance period must be renewed and submitted to the Contracting Officer prior to expiration.

#### ] [1.5.4 Qualified Hazardous Paint Removal Contractor

The Painting Contractor must be a certified [SSPC QP 2](#) [Category A] [Category B] Painting Contractor for all surface preparation or coating application. Submit a copy of the applicable [SSPC Certificate](#). The contractor must have been certified prior to award of this contract and must remain certified for the duration of this contract. Submit all renewals if they occur during the contract performance period. Renewals must be achieved prior expirations occurring.

#### ] [1.5.5 Qualified Shop Painting Contractor

The Painting Contractor must be a certified [SSPC QP 3](#) Painting Contractor for all off-site surface preparation or coating application. Submit a copy of the applicable [SSPC Certificates](#). The contractor must have been certified prior to award of this contract and must remain certified for the duration of this contract. Submit all renewals if they occur during the contract performance period. Renewals must be achieved prior expirations occurring.

#### ] [1.5.6 Qualified Coating Applicator

Submit records of qualification tests for each [Qualified Coating Applicator](#). Prior to the initiation of any work all coating applicators must be tested and certified as meeting the requirements of [ASTM D4228](#). Certification must be administered by an authorized government representative. Applicators failing the certification procedure will not be permitted to apply any paint on the project.

#### 1.5.6.1 Certification Test Procedure

Conduct certification testing of coating applicators at the job site in

coordination with the Contracting Officer. Supply the fabricated test plates to be used for the tests and provide crane service, rigging, and any other work necessary to provide accessibility for the certification testing and inspection. The test plate must be painted in a near vertical position. In preparation, clean and prepare the test plate in accordance with the requirements of the contracted work. Perform abrasive blasting with the blast media to be used in the contract. The paints to be applied are Contractor supplied materials and are those previously tested and approved for use on the contract. Paints must be applied as specified in this contract. The painter being tested must mix and thin the paints to be used in the test and set up and adjust the application equipment for use. Each painter must apply each of the types of paint comprising the specified system. The contractor's QC inspector must be present during the procedure to monitor the actions of the painter being tested.

#### 1.5.6.2 Certification Criteria

Evaluate the paint applicator based on the conformance of the applied paint system to the requirements of this specification. Deficiencies in the coatings, improper mixing or improper application methods are basis for failure. The authorized Government Representative is the sole judge as to the acceptability of each coating applicator's performance.

#### 1.5.7 Coating Thickness Gage Qualification

Submit [Coating Thickness Gage Qualification](#) documentation of manufacturer's certification for all coating thickness gages. Use magnetic flux thickness gages as described in [ASTM D7091](#) to make all coating thickness measurements on ferrous metal substrates. Use eddy current thickness gages as described in [ASTM D7091](#) to measure coating thickness on all nonferrous metal substrates. Gages to be used on the job must have an accuracy of 3 percent or better and be certified by the manufacturer as meeting this requirement.

#### 1.5.8 Certified Coating Inspector

Provide a certified coating inspector who is listed as either SSPC-PCI Level 2, or NACE CIP Level 2 for all surface preparation and painting activities. Submit a copy of the applicable SSPC or NACE Certificates. Submit all renewals if they occur during the contract performance period. Renewals must be achieved prior expirations occurring.

### 1.6 DELIVERY, STORAGE, AND HANDLING

Process and package paints to ensure that within a period of one year from date of manufacture, they will not gel, liver, or thicken deleteriously, or form gas in the closed container. Paints, unless otherwise specified or permitted, must be packaged in standard containers not larger than 5 gal, with removable friction or lug-type covers. [Containers for vinyl-type paints must be lined with a coating resistant to solvents in the formulations and capable of effectively isolating the paint from contact with the metal container.](#) Each container of paint or separately packaged component thereof must be labeled to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name, and formula or specification number of the paint together with special labeling instructions, when specified. Paint must be delivered to the job in unbroken containers. Paints that can be harmed by exposure to cold weather must be stored in ventilated, heated shelters. All paints must be stored under cover from the elements and in locations free from sparks and flames.



## 1.7 AMBIENT CONDITIONS

Paint must be applied in accordance with the manufacturers written instructions or to the special requirements contained herein. Surfaces that are less than 5 degrees F above the dew point temperature must be monitored closely to assure that are completely free of moisture as determined by sight and touch. Paint must not be applied to surfaces upon which there is detectable frost or ice. Except as otherwise specified, paint must not be applied if the temperature of the surfaces to be painted and of air in contact therewith is less than 45 degrees F during paint application nor if the surfaces can be expected to drop to 32 degrees F or lower before the film has dried to a reasonably firm condition. During periods of inclement weather, painting may be continued by enclosing the surfaces and utilizing climate control equipment (e.g. dehumidification, heaters, etc.), provided the minimum temperatures and surface dryness requirements prescribed previously are maintained. Paint must not be applied to surfaces heated by direct sunlight or other sources to temperatures that will cause detrimental blistering, pinholing, or porosity of the film.

## PART 2 PRODUCTS

### 2.1 PRODUCT SAMPLES

Submit product samples of each batch of thinner, solvent, and paint to the Government for testing. Submit [manufacturer's Safety Data Sheet](#) (SDS) for each type of paint used; for products that are specified to be applied in accordance with the manufacturer's recommendations, submit the paint manufacturer's product data sheet (PDS) or other written instructions for those products. Allow at least 30 days from time of delivery to the contracting officer for testing of samples of paints and thinners. Sampling may be at the jobsite or source of supply. Coordinate sampling and submission of all samples of paint and thinner with the Contracting Officer. Standard sample size for liquid paints and thinners is 1-quart; powders and other additives for multi component paints may be of appropriately smaller size. The sample must be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Testing will be performed by the Government. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of [\_\_\_\_\_] dollars for each paint sample retested and [\_\_\_\_\_] dollars for each thinner retested.

### 2.2 SPECIAL PAINT FORMULAS

Special paints must have the composition as indicated in the formulas listed herein. Where so specified, package paint formulation components in separate containers for mixing on the job. If not specified or otherwise prescribed, the color must be that naturally obtained from the required pigmentation.

### 2.3 PAINT FORMULATIONS

Special paint formulas must comply with the following:

#### 2.3.1 Formula V-102E

This formula is for Vinyl-Type Ready-Mixed Aluminum Impacted Immersion Coating, the ingredients are shown below.

INGREDIENTS	PERCENT BY MASS
Vinyl Resin, Type 3	18.2
Aluminum Powder	8.3
Plasticizer	3.1
Methyl Isobutyl Ketone (MIBK)	33.8
Toluene	36.6
Total	100.0

- a. Furnish the paint with the aluminum pigment mixed into the vehicle.
- b. The finished paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods, and have a viscosity between 60 and 90 seconds using ASTM D1200 and a No. 4 Ford cup.

#### 2.3.2 Formula V-103C

This formula is for Vinyl-Type Black-Finish Impacted Immersion Coating, the ingredients are shown below.

INGREDIENTS	PERCENT BY MASS
Vinyl Resin, Type 3	20.0
Carbon Black	1.5
Plasticizer	3.4
Methyl Isobutyl Ketone (MIBK)	36.0
Toluene	39.1
Total	100

- a. Disperse the carbon black to a fineness of grind ASTM D1210 of not less than 7 on the Hegman scale. A paste composed of carbon black milled into a Type 3 vinyl resin dissolved in an appropriate solvent may be used provided the finished product has the specification composition and grind. Material must be free from seeding, gelling, and other deleterious effects. No grinding aids, antissettling agents, or any other materials except those shown in the formula will be permitted.
- b. The finished paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods, and have a viscosity between 60 and 90 seconds using ASTM D1200 and a No. 4 Ford cup.

#### 2.3.3 Formula V-106D

This formula is for Vinyl-Type Red Oxide (Light or Dark Color) Impacted Immersion Coating, the ingredients are shown below.

INGREDIENTS	PERCENT BY MASS
Vinyl Resin, Type 3	5.50
Vinyl Resin, Type 4	11.20
Synthetic Iron Oxide (Red) (Light or Dark Color)	15.80
Plasticizer	2.90
Methyl Isobutyl Ketone	31.00
Toluene	33.54
Propylene Oxide	0.06
Total	100.00

- a. Disperse the pigment by means of pebble mills or other approved methods to produce a fineness of grind (ASTM D1210) of not less than 7 on the Hegman scale. Grinding in steel-lined or steel-ball mills will not be permitted. No grinding aids, antissettling agents, or any other materials, other than those listed in the formula, will be permitted.
- b. The finished paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods, and have a viscosity between 60 and 90 seconds using ASTM D1200 and a No. 4 Ford cup.
- c. Furnish the paint in two colors which are obtained by the alternative use of synthetic red iron oxide pigments of different shade. The dark paint must reasonably approximate color 10076 of SAE AMS-STD-595A, and light colored paint must be readily distinguishable in the field from the dark. Furnish the two shades in the volume ratio designated by the purchaser.

#### 2.3.4 Formula VZ-108D

This formula is for Vinyl-Type Zinc-Rich Impacted Immersion Coating, the ingredients are shown below.

INGREDIENTS	PERCENT BY WEIGHT	POUNDS	GALLONS
COMPONENT A			
Vinyl Resin, Type 3	16.6	109.2	9.65
Methyl Isobutyl Ketone	80.6	528.9	79.30
Suspending Agent E	0.7	4.6	0.28
Suspending Agent F	0.4	2.7	0.19

INGREDIENTS	PERCENT BY WEIGHT	POUNDS	GALLONS
Methanol	0.5	3.3	0.50
Synthetic Iron Oxide (Red)	1.2	7.9	0.19
Total	100.0	656.6	90.11
COMPONENT B			
Silane B	100.0	4.1	0.47
COMPONENT C			
Zinc Dust	100.0	550.0	9.42
Total Volume			100.00 (mixed paint)

- a. Disperse the iron oxide and suspending agents into the vehicle (Component A) to a fineness of grind of not less than 4 on the Hegman scale (ASTM D1210). Grinding in steel-lined containers or using steel-grinding media will not be permitted. The paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods. The sole purpose of the iron oxide pigment is to produce a contrasting color. A red iron oxide-type 3 vinyl resin vehicle paste may be used in place of dry iron oxide provided compensating adjustments are made in the additions of Type 3 resin and methyl isobutyl ketone. The finished product with zinc dust added must produce a paint which has a red tone upon drying and a reflectance of not more than 16 (ASTM E1347).
- b. Supply VZ-108D paint as a kit. Each kit must consist of 4.5 gal ( 33.1 pounds) of Component A in a 5-gallon lug closure type pail, 27.5 pounds of zinc dust (Component C) packaged in a 1-gal plastic pail, and 3 fluid ounces of silane (Component B) packaged in a glass bottle of suitable size having a polyethylene lined cap. Place the bottle of silane on the zinc dust in the 1-gal pail. In addition to standard labeling requirements, identify each container of each component as to component type. Each container label of Component A must carry the following: MIXING AND APPLICATION INSTRUCTIONS: WARNING - THIS PAINT WILL NOT ADHERE TO STEEL SURFACES UNLESS COMPONENT B IS ADDED. Remove the 3 ounces of bottled Component B (silane) from the Component C (zinc dust) container and add to the base paint Component A) with thorough stirring. Then sift the zinc dust into the base paint while it is being vigorously agitated with a power-driven stirrer and continue the stirring until the zinc dust has been dispersed. At some point strain the mixed paint through a 30-60 mesh screen to prevent zinc dust slugs from reaching the spray gun nozzle. Stir the paint continuously during application at a rate that will prevent settling. If spraying is interrupted for longer than 15 minutes, vigorously whip the entire length of the hose to redisperse the zinc. If the spraying is to be interrupted for more than 1 hour, empty the hose by blowing the paint back into the paint pot. Thinning will not normally be required when ambient temperatures are below about 80 degrees F, but when the ambient and steel temperatures are higher, methyl isoamyl ketone (MIAK) or

methyl isobutyl ketone (MIBK) should be used. If paint is kept covered at all times, its pot life will be about 8 days.

#### 2.3.5 Formula V-766E

This formula is for Vinyl-Type White (or Gray) Impacted Immersion Coating, the ingredients are shown below.

INGREDIENTS	PERCENT BY MASS
Vinyl Resin, Type 3	5.6
Vinyl Resin, Type 4	11.6
Titanium Dioxide and (for Gray) Carbon Black	13.0
Plasticizer	2.9
Methyl Isobutyl Ketone	32.0
Toluene	34.7
Ortho-Phosphoric Acid	0.2
Total	100.0

- a. Disperse the pigment by means of pebble mills or other approved methods to produce a fineness of grind (ASTM D1210) of not less than 7 on the Hegman scale. Grinding in steel-lined or steel-ball mills will not be permitted. No grinding aids, antissettling agents, or any other materials except those shown in the formula will be permitted. Measure the ortho-phosphoric acid accurately and dilute it with at least four parts of ketone to one part of acid. Add it slowly into the finished paint with constant and thorough agitation.
- b. The finished paint must show the proper proportions of specified materials when analyzed by chromatographic and/or spectrophotometric methods, and have a viscosity between 60 and 90 seconds using ASTM D1200 and a No. 4 Ford cup.
- c. Furnish the white and gray paints in the volume ratio designated by the purchaser. The gray paint must contain no pigments other than those specified. Include enough carbon black to produce a dry paint film having a reflectance of 20-24 (ASTM E1347). The resulting gray color must approximate color 26231 of SAE AMS-STD-595A.

#### 2.3.6 Formula C-200A, Coal Tar-Epoxy (Black) Paint

The paint must conform to SSPC Paint 16 manufactured with Type 1 pitch. In addition to standard labeling, container labels must include the term, Corps of Engineers Formula C-200A.

#### 2.4 INGREDIENTS FOR SPECIAL PAINT FORMULAS

The following ingredient materials and thinners apply only to those special

paints whose formulas are shown above in detail.

#### 2.4.1 Pigments and Suspending Agents

##### 2.4.1.1 Aluminum Powder

For vinyl paint aluminum powder must conform to [ASTM D962](#), Type 1, Class B.

##### 2.4.1.2 Carbon Black

Carbon black must conform to [ASTM D561](#), Type I or II.

##### 2.4.1.3 Zinc Dust

Zinc dust pigment must conform to [ASTM D520](#), Type II.

##### 2.4.1.4 Iron Oxide

Iron oxide, (Dry) synthetic (red), must conform to [ASTM D3721](#). In addition, the pigment must have a maximum oil absorption of 24 and a specific gravity of 4.90 to 5.20 when tested in accordance with [ASTM D281](#) and [ASTM D153](#), Method A, respectively. When the pigment is dispersed into specified vinyl paint formulation, the paint must have color approximating [SAE AMS-STD-595A](#) color 10076 (dark red paint), and show no evidence of incompatibility or reaction between pigment and other components after 6 months storage.

##### 2.4.1.5 Titanium Dioxide

Titanium dioxide in vinyl paint Formula V-766E must be one of the following: Kronos 2160 or 2101, Kronos, Inc.; Ti-Pure R-960, E.I. Dupont DeNemours and Co., Inc.

##### 2.4.1.6 Suspending Agent E

Suspending Agent E must be a light cream colored finely divided powder having a specific gravity of 2 to 2.3. It must be an organic derivative of magnesium aluminum silicate mineral capable of minimizing the tendency of zinc dust to settle hard without increasing the viscosity of the paint appreciably. M-P-A-14, produced by Elementis Specialties, has these properties.

##### 2.4.1.7 Suspending Agent F

Suspending Agent F must be a light cream colored finely divided powder having a specific gravity of approximately 1.8. It must be an organic derivative of a special montmorillonite (trialkylaryl ammonium hectorite). Bentone 27, produced by Elementis Specialties, has these properties.

#### 2.4.2 Resins, Plasticizer, and Catalyst

##### 2.4.2.1 Plasticizer

The plasticizer must be either Di 2-propyl Heptyl Phthalate (DPHP) or Diisodecyl Phthalate (DIDP). DPHP must have an ester content of not less than 99.5 percent ([ASTM D3465](#)), must contain not more than 0.1 percent water, and must have an acid number ([ASTM D1045](#)) of not more than 0.07. DIDP must have a purity of not less than 99.0 percent, must contain not more than 0.1 percent water, and must have an acid number ([ASTM D1045](#)) of not

more than 0.10.

#### 2.4.2.2 Vinyl Resin, Type 3

Vinyl resin, Type 3, must be a vinyl chloride-acetate copolymer of medium average molecular weight produced by a solution polymerization process and must contain (by weight) 85 +/- 1.0 percent vinyl chloride and 15 +/- 1.0 percent vinyl acetate by weight. The resin must have film-forming properties and must, in specified formulations, produce results equal to Vinnol H 15/50, as manufactured by Wacker Chemie AG.

#### 2.4.2.3 Vinyl Resin, Type 4

Vinyl resin, Type 4, must be a vinyl chloride-acetate type produced by a solution polymerization process, must contain 1 percent interpolymerized dicarbonic acid, 84 +/- 1.0 percent vinyl chloride, and 15 +/- 1.0 percent vinyl acetate. The resin must have film-forming properties and must, in the specified formulations, produce results equal to Vinnol H 15/45 M, as manufactured by Wacker Chemie AG.

#### 2.4.2.4 Ortho-phosphoric Acid

Ortho-phosphoric acid must be a chemically pure 85-percent grade.

#### 2.4.3 Solvent and Thinners

##### 2.4.3.1 Methanol

Methanol (methyl alcohol) must conform to [ASTM D1152](#).

##### 2.4.3.2 Methyl Ethyl Ketone

Methyl ethyl ketone (MEK) must conform to [ASTM D740](#).

##### 2.4.3.3 Methyl Isobutyl Ketone

Methyl isobutyl ketone (MIBK) must conform to [ASTM D1153](#).

##### 2.4.3.4 Methyl Isoamyl Ketone

Methyl isoamyl ketone (MIAK) must conform to [ASTM D2917](#).

##### 2.4.3.5 Toluene

Toluene must conform to [ASTM D841](#).

#### 2.4.4 Silane B

Silane B for Formula VZ-108D must be N-beta-(aminoethyl)-gamma-aminopropyltrimethoxy silane. Silquest A-1120, produced by Momentive Performance Materials Inc., and Silane Z-6020, produced by Dow Corning Corporation, are products of this type.

#### 2.4.5 Propylene Oxide

Propylene oxide must be a commercially pure product suitable for the intended use.

### 2.5 TESTING

### 2.5.1 Chromatographic Analysis

Solvents in vinyl paints and thinners are subject to analysis by programmed temperature gas chromatographic methods and/or spectrophotometric methods, employing the same techniques that give reproducible results on prepared control samples known to meet the specifications. If the solvent being analyzed is of the type consisting primarily of a single chemical compound or a mixture of two or more such solvents, interpretation of the test results must take cognizance of the degree of purity of the individual solvents as commercially produced for the paint industry.

### 2.5.2 Vinyl Paints

Vinyl paints are subject to the following adhesion test. When V-766 or V-106 formulations are tested, spray apply 5 to 7 mils (dry) to mild steel panels. The steel panels must be essentially free of oil or other contaminants that may interfere with coating adhesion and be dry blast cleaned to a White Metal grade in compliance with SSPC SP 5/NACE No. 1. The surface must have an angular profile of 2.0 to 2.5 mils as measured by ASTM D4417, Method C. When V-102 or V-103 formulations are tested, spray apply the product over 1.5 to 2.5 mils (dry) of V-766 or V-106 known to pass this test. When VZ-108 is tested, the coating must be mixed in its proper proportions and then spray applied to a dry film thickness of 1.5 to 2.5 mils above the blast profile. The VZ-108 must be top coated with a V-766 known to pass this test. In all cases, the complete system must have a total dry film thickness of 5 to 7 mils above the blast profile. After being air dried for 2 hours at room temperature, dry the panel in a vertical position for 16 hours at 120 degrees F. After cooling for 1 hour, immerse the panel in tap water at 85 to 90 degrees F for 48 to 72 hours. Immediately upon removal, dry the panel with soft cloth and examine for adhesion as follows: With a pocket knife or other suitable instrument, make two parallel cuts at least 1 inch long, 1/4 to 3/8 inch apart through the paint film to the steel surface. Make a third cut perpendicular to and passing through the end of the first two. With the tip of the knife blade, loosen the film from the panel from the third cut between the parallel cuts for a distance of 1/8 to 1/4 inch. With the panel being held horizontally, grasp the free end of the paint film between the thumb and forefinger and pulled vertically in an attempt to remove the film as a strip from between the first two cuts. Remove the strip of paint film at a rate of approximately 1/10 inch per second and maintaining it in a vertical position during the process of removal. The adhesion is acceptable if the strip of paint breaks when pulled or if the strip elongates a minimum of 10 percent during its removal. Paints not intended to be self-priming must not exhibit any delamination from the primer.

## PART 3 EXECUTION

### 3.1 CLEANING AND PREPARATION OF SURFACES TO BE PAINTED

#### 3.1.1 General Requirements

Clean surfaces to be painted before applying paint or surface treatments. Remove deposits of grease or oil in accordance with SSPC SP 1, prior to mechanical cleaning. Perform solvent cleaning with mineral spirits or other low toxicity solvents having a flash point above 100 degrees F. Use clean cloths and clean fluids to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Protect items not to be prepared or coated from damage by the surface preparation methods. Protect machinery



and electrical components against entry of blast abrasive and dust into working parts. Program cleaning and painting such that dust or other contaminants from the cleaning process do not fall on wet, newly painted surfaces. Protect surfaces not intended to be painted from the effects of cleaning and painting operations. Conduct welding of, or in the vicinity of, previously painted surfaces in a manner to prevent weld spatter from striking the paint and to otherwise reduce coating damage to a minimum. Restore any paint damaged by welding operations to original condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed must be painted before they become inaccessible.

### 3.1.2 Ferrous Surfaces Subject to Atmospheric Exposures

Clean ferrous surfaces that are to be continuously in exterior or interior atmospheric exposure and other surfaces as directed by means of [power tools or by dry blasting to the brush-off grade] [dry blasting to a commercial grade]. Perform cleaning and priming in the shop unless otherwise directed or permitted. [Conduct power tool cleaning in conformance with the requirements of [SSPC SP 3.](#)] [Conduct brush-off blast cleaning in conformance with the requirements of [SSPC 7/NACE No.4.](#)] [Conduct commercial blast cleaning in conformance with the requirements of [SSPC SP 6/NACE No.3.](#)] Clean welds and adjoining surfaces within a few inches (centimeters) of weld flux, spatter, and other harmful deposits by blasting, power impact tools, power wire brush, or such combination of these and other methods as may be necessary for complete removal of each type of deposit. The combination of cleaning methods need not include blasting when preparation of the overall surfaces is carried out by the power tool method; however, brush scrubbing and rinsing with clean water, after mechanical cleaning is completed is required unless the latter is carried out with thoroughness to remove all soluble alkaline deposits. Limit wetting of the surfaces during water-washing operations to the weld area required to be treated, and assure that wetted areas, including any crevices, are completely dry before painting. Welds and adjacent surfaces cleaned thoroughly by blasting alone will be considered adequately prepared provided that weld spatter not dislodged by the blast stream is removed with impact or grinding tools. Round all sharp edges including those caused by corrosion, to a minimum radius of  $1/16$  inch to ensure adequate paint coverage. Prime all surfaces as soon as practicable after cleaning and in all cases prior to contamination or deterioration of the prepared surfaces. To the greatest degree possible, clean (and prime) all steel surfaces prior to lengthy outdoor storage.

#### 3.1.2.1 Coated Ferrous Surfaces Subject to Atmospheric Exposures

Power tool clean coated ferrous surfaces to be overcoated in accordance with [SSPC SP 3.](#) The entire surface to be overcoated does not have to be power tool cleaned provided that all surfaces are free of all loose rust, loose paint and visible surface contaminants. Following power tool cleaning, further clean surfaces by power washing using a rotating tip and pressures of 1500 to 5000 PSI. Adjust water pressure such that all chalk is removed without significantly eroding the existing coating. After drying, spot prime all surfaces as soon as practicable and in all cases prior to contamination or deterioration of the prepared surfaces.

#### 3.1.3 Ferrous Surfaces Subject to Severe Exposure

Dry blast-clean ferrous surfaces subject to extended periods of immersion or as otherwise required to white metal according to [SSPC SP 5/NACE No. 1.](#)

The blast profile must be angular with a minimum profile height of 1.5 mils. Select appropriate abrasive size and equipment operating parameters to limit maximum surface profile on new steel to 2.5 mils and to prevent increasing existing profile height on previously blasted steel. Where an existing profile is encountered, remove representative spots of existing coating with a chemical stripper and measure and document the existing profile prior to initiating blasting operations. Measure all surface profiles in accordance with ASTM D4417, Method C. Steel shot or other abrasives that do not produce an angular profile must not be used. If recycled blast media is used, maintain an appropriate particle size distribution so that the specified profile is consistently obtained. Round all sharp edges including those caused by corrosion, to a nominal 1/16 inch radius and reblast the areas prior to painting. Remove weld spatter not dislodged by blasting with impact or grinding tools and reblast the areas prior to painting. Surfaces must be dry at the time of blasting. Conduct blast cleaning to SSPC SP 5/NACE No. 1 in the field and, unless otherwise specifically authorized, after final erection. Within 8 hours after blast cleaning, and in any case prior to the deposition of any detectable moisture, contaminants, or corrosion, clean all ferrous surfaces of dust and abrasive particles by brush, vacuum cleaner, and/or blown down with clean, dry, compressed air, and apply the first coat of paint. Authorization to extend this 8 hour coating requirement for shop application, application within dehumidified containment, or other conditions will not be granted. Upon written request by the Contractor, the Contracting Officer may authorize mill or shop cleaning of assembled or partially assembled components specified to receive one of the vinyl-type paint systems or Systems 6-A-Z and 21-A-Z employing the epoxy zinc-rich primer or Systems 23-A-Z and 23-B-Z employing SSPC Paint 40 moisture cure urethane zinc-rich primer. Shop coat all shop blasted surfaces with the first and second coats of the specified paint system. At the time field painting is initiated, apply an additional single spray coat of the zinc rich primer to the epoxy zinc-rich and moisture cure urethane primed surfaces as specified in the paint system instructions. Maintain the shop coating in good condition by cleaning and touching up of areas damaged during the construction period. If pinpoint or general rusting appears, the defective areas must be reblasted and repainted at no added cost to the Government. Prior to the field application of subsequent coats, thoroughly clean soiled areas of the shop coating and all welds or other unpainted or damaged areas must be cleaned and coated in a manner to make them equivalent to adjacent, undamaged paint surfaces.

#### 3.1.4 Damp and Wet Ferrous Metal Surfaces

Blast-clean ferrous surfaces that are wet with condensation or standing or running water, to white metal according to SSPC SP 5/NACE No. 1. The blast profile must be angular with a minimum profile height of 1.5 mils. Select appropriate abrasive size and equipment operating parameters to limit maximum surface profile on new steel to 2.5 mils and to prevent increasing existing profile height on previously blasted steel. Where an existing profile is encountered, remove representative spots of existing coating with a chemical stripper and measure and document the existing profile prior to initiating blasting operations. Measure all surface profiles in accordance with ASTM D4417, Method C. Steel shot or other abrasives that do not produce an angular profile are not to be used. If recycled blast media is used, maintain an appropriate particle size distribution so that the specified profile is consistently obtained. Round all sharp edges including those caused by corrosion, to a nominal 1/16 inch radius and reblast the areas prior to painting. Remove weld spatter not dislodged by blasting with impact or grinding tools and reblast the areas prior to

painting. Immediately after cleaning and prior to the formation of extensive corrosion products, clean all ferrous surfaces of residual abrasive particles, and apply the first coat of paint in accordance with manufacturer's recommendations. A slightly visible rust bloom is permitted on surfaces to be painted.

### 3.1.5 Non-Ferrous Metal Surfaces

Abrasive blast all non-ferrous metal surfaces to be painted in accordance with SSPC SP 16 in order to roughen the surface and promote adhesion. Only non-metallic abrasives are permitted. All existing coatings must be removed and a minimum surface profile of 1.5 mils must be produced. Measure the surface profile in accordance with ASTM D4417 Method C. Prime all surfaces as soon as practicable after cleaning and in all cases prior to contamination or deterioration of the prepared surfaces.

### 3.1.6 Concrete Surfaces

Permit new concrete surfaces, including concrete floors, to age for a minimum of 30 days prior to painting. Remove grease and oil by solvent cleaning and/or detergent washing followed by rinsing. Remove loosely adherent materials such as dirt, dust, laitance, efflorescence, bleed water residues, or other foreign substances by wire or fiber brushing, scrapers, light sandblasting, or other approved means. For interior walls and floors, abrasive blasting unless otherwise specifically authorized, is restricted to the wet or vacuum type. Remove surface glaze, if present, by light blasting or by scrubbing with a 5-percent solution of phosphoric acid. The texture of the surface after etching must be roughly equivalent to the texture of 80-120 grit sandpaper. If acid etching is used, thoroughly rinse the surface with clean water to remove all traces of the acid. Prior to painting, the concrete must be dry. Determine adequate dryness visually at the time of application by testing according to ASTM D4263 (Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method) at random locations on the surface to be coated. Coatings may be applied only if there are no traces of moisture and surfaces are dry beneath the polyethylene the following day.

### 3.1.7 Plaster Surfaces

At the time of painting, plaster surfaces must be thoroughly dry and clean and free from grit, loose plaster, and surface irregularities. Repair cracks and holes with approved patching materials, properly keyed to the existing surfaces, and sand-papered smooth. Allow plaster to age a minimum of 30 days before painting.

## 3.2 PAINT APPLICATION

### 3.2.1 General

Unless otherwise specified, the finished coating must be free from holidays, pinholes, bubbles, runs, drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Do not initiate the application of initial or subsequent coatings until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Each paint coat must be applied in a manner that will produce an even, continuous film of uniform thickness. Provide special attention to edges, corners, crevices, seams, joints, welds, rivets, corrosion pits, and other surface irregularities to ensure that they receive an adequate thickness of paint. Spray equipment must be

equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles must be as recommended by the spray equipment manufacturer for the material being applied. Airless-type spray equipment may be used only on broad, flat, or otherwise simply configured surfaces, except that it may be employed for general painting if the spray gun is equipped with dual or adjustable tips of proper types and orifice sizes. The use of airless-type equipment is not allowed for the application of vinyl paints.

### 3.2.2 Mixing and Thinning of Coatings other than the Vinyl Formulations

Paints must be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. Incorporate dry-powder pigments specified to be added at the time of use, into the vehicle or base paint with the aid of powered stirrers, in a manner that will produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary to suit conditions of the surface temperature, weather, and method of application, the paint may be thinned immediately prior to use. Thinning, induction time and pot life must comply with the manufacturers written instructions (PDS). Bring any paint that has been stored at a temperature below the manufacturer's application temperature range up to at least 70 degrees F before being mixed and thinned. Its temperature in the spray tank or other working container must not fall below the manufacturer's specified application temperature range during the application. Any paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods must not be used and must be removed from the project site. In order to determine its suitability for application, resample and submit for testing any paint and thinner that is more than 1 year from the date of manufacture or last documented testing. Moisture cure urethane paint must be resampled and resubmitted for testing to determine its suitability for application whenever the paint is more than six months beyond the date of manufacture on the container or more than 6 months beyond the last documented laboratory testing.

### 3.2.3 Time between Surface Preparation and Painting

Surfaces that have been cleaned and/or otherwise prepared for painting must be primed as soon as practicable after such preparation has been completed but, in any event, prior to any deterioration of the prepared surface.

### 3.2.4 Method of Paint Application

Unless otherwise specified, paint must be applied by brush, roller, or spray to ferrous and nonferrous metal surfaces. Special attention must be directed toward ensuring adequate coverage of edges, corners, crevices, pits, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces are subject to the specific approval of the Contracting Officer. Paint on plaster, concrete, or other nonmetallic surfaces must be applied by brush, roller, and/or spray.

### 3.2.5 Coverage and Film Thickness

Film thickness or spreading rates must be as specified hereinafter. Where no spreading rate is specified, apply the paint at a rate consistent with the manufacturer's written instructions. In any event, the combined coats of a specified paint system must completely hide base surface and the finish coats must completely hide undercoats of dissimilar color.

### 3.2.6 Coating Thickness Measurement on Metal

Where dry film thickness requirements are specified for coatings on metal surfaces, make measurements with a gage qualified in accordance with paragraph Coating Thickness Gage Qualification and calibrated and used in accordance with [ASTM D7091](#). Prior to each use, establish the Base Metal Reading (BMR) for the gage as specified in the test method. Verify the accuracy of the gage using plastic shims as specified by the test method both prior to and following each set of measurements. Perform dry film measurements on all areas of the structure being coated in accordance with [SSPC PA 2](#) with Level 1 thickness restrictions. Perform a sufficient number of thickness measurements to ensure that every area on every member is in compliance with the requirements of this contract. Report all thickness measurements as the mean for each spot determination.

### 3.2.7 Progress of Painting Work

Where field painting on any type of surface has commenced, complete the entire painting operation on that portion of the work, including priming and finishing coats, as soon as practicable and without prolonged delays. Allow sufficient time between successive coats to permit them to dry properly for recoating, modifying this period as necessary to suit adverse weather conditions. Paint is considered dry for recoating when it feels firm, does not deform or feel sticky under moderate pressure of the finger, and the application of another coat of paint does not cause film irregularities such as lifting or loss of adhesion of the undercoat. All coats of all painted surfaces must be unscarred and completely integral at the time of application of succeeding coats. At the time of application of each successive coat, clean undercoats of dust, grease, overspray, or foreign matter by means of air blast, solvent cleaning, or other suitable means. Cement and mortar deposits on painted steel surfaces, not satisfactorily removed by ordinary cleaning methods, must be brush-off blast cleaned and completely repainted as required. If necessary for establishment of good adhesion, scuff sand high gloss undercoats, and, solvent wipe, or otherwise treat prior to application of a succeeding coat. Apply field coats on metal after erection except as otherwise specified and except for surfaces to be painted that will become inaccessible after erection.

### 3.2.8 Contacting Surfaces

When riveted or ordinary bolted contact is to exist between surfaces of ferrous or other metal parts of substantially similar chemical composition, such surfaces will not be required to be painted, but any resulting crevices must subsequently be filled or sealed with paint. Contacting metal surfaces formed by high-strength bolts in friction-type connections must not be painted. Where a nonmetal surface is to be in riveted or bolted contact with a metal surface, the contacting surfaces of the metal must be cleaned and given three coats of the specified primer. Unless otherwise specified, corrosion-resisting metal surfaces, including cladding therewith, must not be painted.

### 3.2.9 Drying Time Prior to Immersion

Minimum drying periods after final coat prior to immersion are: epoxy and moisture cure urethane systems at least 5 days, vinyl-type paint systems at least 3 days, and cold-applied coal tar systems at least 7 days. Increase minimum drying periods twofold if the drying temperature is below 65

degrees F and/or if the immersion exposure involves considerable abrasion.

### 3.2.10 Protection of Painted Surfaces

Where shelter and/or heat are provided for painted surfaces during inclement weather, such protective measures must be maintained until the paint film has dried and discontinuance of the measures is authorized. Items that have been painted must not be handled, worked on, or otherwise disturbed until the paint coat is fully dry and hard. Store all metalwork coated in the shop or field prior to final erection out of contact with the ground in a manner and location that will minimize the formation of water-holding pockets; soiling, contamination, and deterioration of the paint film. Damaged areas of paint on such metalwork must be cleaned and touched up without delay. Apply the first field coat of paint within a reasonable period of time after the shop coat and in any event before weathering of the shop coat becomes extensive.

### 3.2.11 Vinyl Paints

#### 3.2.11.1 General

Vinyl paints must be thoroughly mixed and kept at a uniform composition and consistency during application. Any paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods must not be used and must be removed from the project site. In order to determine its suitability for application, resample and submit for testing any paint and thinner that is more than 1 year from the previous documented testing. Each applied coat of vinyl paint must be free from any holidays, pinholes and bubbles. The finished coating must be free of excessive or unsightly brush marks, runs, drops, ridges, waves, laps and variations in color, and texture. Vinyl paints must be spray applied, except that areas inaccessible to spraying must be brushed. Vinyl Paints (Formulas V-102E, V-103C, V-106D, and V-766E) are ready-mixed paints designed to be spray applied over a wide range of ambient temperatures by field thinning with the proper type and amount of thinner. For spray application, they must be thinned as necessary up to approximately 25 percent (1 quart/gallon of base paint) with the appropriate thinner; when ambient and steel temperatures are above normal, up to 40-percent thinning may be necessary for satisfactory application. The zinc-rich vinyl paint (Formula VZ-108D) will normally require thinning only under certain weather conditions. Thinners for vinyl paints must be as follows:

APPROXIMATE AMBIENT AIR TEMPERATURE (Degrees F)	
Below 50	MEK
50 - 70	MIBK
Above 70	MIAC

Vary the amount of thinner to provide a wet spray and avoid deposition of particles that are semidry when they strike the surface. Do not apply vinyl paints when the temperature of the ambient air and receiving surfaces is less than 35 degrees F nor when the receiving surfaces are higher than 125 degrees F. Each double spray coat of vinyl paint must consist of a preliminary stripe coat applied by spray, brush, or combination thereof on edges, corners, interior angles, pits, seams, crevices, junctions of joining members, rivets, weld lines, and similar surface irregularities

followed by an overall double spray coat. A double spray coat of vinyl-type paint consists of applying paint to a working area of not less than several hundred square feet (meters) in a single, half-lapped pass, followed after drying to at least a near tack-free condition by another spray pass applied at the same coverage rate and where practicable at right angles to the first. Rivets, bolts, and similar surface projections must receive sprayed paint from every direction to ensure complete coverage of all faces. Pits, cracks, and crevices must be filled with paint insofar as practicable, but in any event, all pit surfaces must be thoroughly covered and all cracks and crevices must be sealed off against the entrance of moisture. Keep fluid and atomization pressures as low as practicable consistent with good spraying results. Application of more than 2.0 mils, average dry film thickness, of vinyl paint per double spray coat typically indicates semidry application and must be avoided. Except where otherwise indicated, an undercoat of the vinyl-type paint may receive the next coat any time after the undercoat is tack-free and firm to the touch, provided that no speedup or delay in the recoating schedule results in film defects such as sags, runs, air bubbles, air craters, or poor intercoat adhesion. Do not walk on, or otherwise abrade the prime coat or any other coat until it has hardened sufficiently to resist mechanical damage.

#### 3.2.11.2 Vinyl Zinc-Rich Primer

Primer must be field mixed combining components A, B, and C in accordance with label instructions. After mixing, keep the paint covered at all times to avoid contamination and apply the mixed paint within 8 days after mixing. When the ambient and/or steel temperature is below about 80 degrees F, the paint will not normally require thinning; however, the paint must at all times contain sufficient volatiles (thinners) to permit it to be satisfactorily atomized and to provide a wet spray and to avoid deposition of particles that are semidry when they reach the surface. The paint must be stirred continuously during application at a rate that will prevent the zinc dust from settling. When spraying is resumed after any interruption of longer than 15 minutes, the entire length of the material hose must be whipped vigorously until any settled zinc is redispersed. Long periods of permitting the paint to remain stagnant in the hose must be avoided by emptying the hoses whenever the painting operation is to be suspended for more than 1 hour. Keep the material (paint) hoses as short as practicable, preferably not more than 50 feet in length. Equipment used for spraying this zinc primer must not be used for spraying other vinyl-type paints without first being thoroughly cleaned, since many of the other paints will not tolerate zinc contamination. Do not use any type of hot spray. An average dry film thickness of up to 2.5 mils may be applied in one double-spray coat. Unless specifically authorized, any coat of VZ-108 must receive a succeeding coat within 8 days.

#### 3.2.11.3 Repair of Vinyl Coating Defects

Coating defects should be repaired when they are first observed but must be repaired prior to coating acceptance. Runs and sags may be brushed out before becoming dry. Pinholes must be physically closed by scrubbing with a brush wet with ketone solvent before the succeeding coat is applied. Overspray that will not be melted smooth by the succeeding coat must be removed by scrubbing with a brush wet with ketone solvent. Minor overspray in the final coat that results only in a reduced gloss at the outer limits of the spray pattern is not considered a defect and requires no additional attention. Insufficient thickness or incomplete hiding must be corrected with additional paint before the succeeding coat is applied. If any defect extends to the substrate, it must be determined if the substrate is

corroding. In the case of pinholes it may be necessary to use magnification to observe the substrate. If the substrate is showing any corrosion, the required surface preparation must be restored by spot blasting, and the entire coating system replaced at that location. Following the spot blasting the edges of the remaining coating must be scrubbed with ketone solvent to assure all remaining coating is tightly adhering before the new coating is applied. If VZ-108 does not receive the required succeeding coat within the required 8 days, it must be removed by abrasive blasting and replaced.

### 3.2.12 Coal Tar-Epoxy (Black) Paint (Formula C-200A)

#### 3.2.12.1 Mixing

Add Component B to previously stirred Component A and thoroughly mix together with a heavy-duty mechanical stirrer just prior to use. The use of not more than 1 pint of xylene thinner per 1 gal of paint is permitted to improve application properties and extend pot life. The pot life of the mixed paint, extended by permissible thinning, may vary from 2 hours in very warm weather to 5 or more hours in cool weather. Pot life in warm weather may be extended by precooling the components prior to mixing; cooling the mixed material; and/or by slow, continuous stirring during the application period. Apply the mixed material before unreasonable increases in viscosity take place.

#### 3.2.12.2 Application

High-pressure airless spray equipment must be equipped with spray tips of appropriate size for the structural members being coated. Brush application must be with a stiff-bristled brush heavily laden with material and wielded in a manner to spread the coating smoothly and quickly without excessive brushing. The coverage rate of the material is approximately 110 square feet/gal per coat to obtain 20 mils (dry thickness) in a two coats of the C-200a. The paint must flow together and provide a coherent, pinhole-free film. The direction of the spray passes (or finish strokes if brushed) of the second coat must be at right angles to those of the first where practicable.

#### 3.2.12.3 Subsequent Coats

Except at the high temperatures discussed later in this paragraph, the drying time between coal tar-epoxy coats must not be more than 72 hours, and application of a subsequent coat as soon as the undercoat is reasonably firm is strongly encouraged. Where the temperature for substrate or coating surfaces during application or curing exceeds or can be expected to exceed 125 degrees F as the result of direct exposure to sunlight, the surfaces must be shaded by overhead cover or the interval between coats reduced as may be found necessary to avoid poor intercoat adhesion. Here, poor intercoat adhesion is defined as the inability of two or more dried coats of coal tar-epoxy paint to resist delamination when tested aggressively with a sharp knife. Under the most extreme conditions involving high ambient temperatures and sun-exposed surfaces, reduce the maximum drying time between coats to 10 hours, and the reduction of this interval to a few hours or less is strongly encouraged. Where the curing time of a coal tar-epoxy undercoat exceeds 72 hours at normal temperatures, 10 hours at extreme conditions, or where the undercoat develops a heavy blush, or when spot repair of damage is required, it must be given one of the following treatments before the subsequent coat is applied:



- a. Etch the coating surface lightly by brush-off blasting, using fine abrasive, low air pressure, and a nozzle-to-surface distance of approximately 3 feet.
- b. Remove the blush and/or soften the surface of the coating by wiping it with cloths dampened with 1-methyl-2-pyrrolidone. The solvent may be applied to the surface by fog spraying followed by wiping, but any puddles of solvent must be mopped up immediately after they form. Apply the subsequent coat in not less than 15 minutes or more than 3 hours after the solvent treatment.

#### 3.2.12.4 Repair of Coal Tar-Epoxy (Black) Paint (Formula C-200A) Defects

Coating defects should be repaired when they are first observed but must be repaired prior to coating acceptance. Runs, sags, pinholes and other visible application defects in any coat may be brushed out before the material cures. Excessive thickness as a result of runs, sags or heavy application of any coat that has been allowed to cure must be reduced to the specified thickness limitation. Any actions that damage the required surface profile must be followed by spot blasting to restore the profile prior to reapplication of the coating system in that area.

#### 3.2.12.5 Ambient Temperature

Coal tar-epoxy paint must not be applied when the receiving surface or the ambient air is below 50 degrees F nor if it can be reasonably anticipated that the average ambient temperature will be 50 degrees F or higher for the 5-day period subsequent to the application of any coat.

#### 3.2.12.6 Safety

In addition to the safety provisions in paragraph SAFETY, HEALTH, AND ENVIRONMENT, other workers as well as painters must avoid inhaling atomized particles of coal tar-epoxy paint and contact of the paint with the skin.

### 3.3 PAINT SYSTEMS APPLICATION

The required paint systems and the surfaces to which they are to be applied are shown in this paragraph, and/or in the drawings. Supplementary information follows.

#### 3.3.1 Fabricated and Assembled Items

Items that have been fabricated and/or assembled into essentially their final form and that are customarily cleaned and painted in accordance with the manufacturer's standard practice will be exempted from equivalent surface preparation and painting requirements described herein, provided that:

- a. Surfaces primed (only) in accordance with such standard practices are compatible with specified field-applied finish coats.
- b. Surfaces that have been primed and finish painted in accordance with the manufacturer's standard practice are of acceptable color and are capable of being satisfactorily touched up in the field.
- c. Items expressly designated herein to be cleaned and painted in a specified manner are not coated in accordance with the manufacturer's standard practice if different from that specified herein.

### 3.3.2 Surface Preparation

The method of surface preparation and pretreatment shown in the tabulation of paint systems is for identification purposes only. Cleaning and pretreatment of surfaces prior to painting must be accomplished in accordance with detailed requirements previously described.

### 3.3.3 System No. 1

This epoxy paint system must have been tested and passed all the test requirements of **SSPC PS 26.00**. Application must be by spray, brush or roller in accordance with the manufacturer's written instructions. Application includes a preliminary stripe coat applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. Dry film thickness per coat must be within plus or minus 20 percent of that recommended by the manufacturer. Application of the system in less than two coats will not be accepted. Mix and thin the epoxy coating in accordance with the manufacturers written directions. Mixed coating material that has exceeded the manufacturers pot life, that have been mixed for more than 8 hours or that have thickened appreciably must not be applied. The manufacturer's recommendations for minimum and maximum dry time between coats must be met.

### 3.3.4 System No. 3

Apply paint by spray to an average dry film thickness of a minimum of **6.0 mils** for the completed system with a minimum thickness at any spot of not less than **5.0 mils**. Build up approximately **3.0 mils** with no spot less than **2.5 mils** of the total dry film thickness with Formula V-766E paint. The specified film thickness must be attained in any event, and any additional coats needed to attain specified thickness must be applied at no additional cost to the Government. Attaining the specified film thickness in fewer than the prescribed number of coats or spray passes will be acceptable provided the heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than **2.0 mils** (dry film thickness) per double spray coat or more than **1.0 mil** per single spray pass typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

### 3.3.5 System No. 3-A-Z

Apply paint by spray to an average dry film thickness of a minimum of **6.5 mils** for the completed system, and a thickness at any spot of not be less than **5.5 mils**. The dry film thickness of the zinc-rich coat must be approximately **2.5 mils** with no spot less than **2.0 mils**. The thickness of the V-766E mid coat must be sufficient to completely hide the primer. Specified film thickness, including the prescribed total, must be attained in any event, and any extra coats needed to attain specified thickness must be applied at no additional cost to the Government. Attaining of the specified film thickness in fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than **2.0 mils** (dry film thickness) per double spray coat or more than **1.0 mil** per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

### 3.3.6 System No. 4

Apply paint by spray applied to an average dry film thickness of a minimum of 7.5 mils for the completed system, with a thickness at any spot of not less than 6.0 mils. The specified total film thickness must be attained in any event, and additional coats needed to attain the specified thickness must be applied at no additional cost to the Government. Attaining the specified film thickness in fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than 2.0 mils (dry film thickness) per double spray coat or more than 1.0 mil per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

### 3.3.7 System No. 5-A-Z

Apply paint by spray to an average dry film thickness of a minimum of 6.5 mils for the completed system with the thickness at any spot not be less than 5.0 mils. The approximate dry film thickness after application of the first and second double spray coats must be 2.5 and 4.0 mils, respectively. The zinc primer must not be less than 2.0 mils at any spot. The specified film thickness must be attained in any event, and any additional coats needed to attain specified thickness must be applied at no additional cost to the Government. Attaining the specified film thickness in fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than 2.0 mils (dry film thickness) per double spray coat or more than 1.0 mil per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

### 3.3.8 System No. 5-C-Z

Apply paint by spray to an average dry film thickness of a minimum of 7.0 mils for the completed system, and the thickness at any spot of not less than 5.5 mils. The dry film thickness of the zinc-rich coat must be approximately 2.5 mils with the thickness at any spot not less than 2.0 mils. Specified film thickness, including the prescribed total, must be attained in any event, and any extra coats needed to attain specified thickness must be applied at no additional cost to the Government. Attaining of the specified film thickness in fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than 2.0 mils (dry film thickness) per double spray coat or more than 1.0 mil per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

### 3.3.9 System No. 5-D

Apply paint by spray to an average dry film thickness of a minimum of 7.5 mils for the completed system, with the thickness at any spot of not be less than 6.0 mils. The specified total film thickness must be attained in any event, and any additional coats needed to attain specified thickness must be applied at no additional cost to the Government. Attaining the specified film thickness in fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application

of more than 2.0 mils (dry film thickness) per double spray coat or more than 1.0 mils per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

#### 3.3.10 System No. 5-E-Z

Apply paint by spray to an average dry film thickness of a minimum of 7.0 mils for the completed system, with the thickness at any spot of not be less than 5.5 mils. The dry film thickness of the zinc-rich primer must be approximately 2.5 mils with no spot less than 2.0 mils. The specified film thickness must be attained in any event, and any extra coats needed to attain the specified thickness must be applied at no additional cost to the Government. Attaining the specified film thickness by applying fewer than the prescribed number of coats or spray passes will be acceptable provided heavier applications do not cause pinholes, bubbles, blisters, or voids in the dried film. The application of more than 2.0 mils (dry film thickness) per double spray coat nor more than 1.0 mil per single spray pass of nonzinc paint typically indicates the paint is not being applied wet enough to properly flow out and must be avoided.

#### 3.3.11 System No. 6

Apply paint by spray or brush with a minimum of two coats to provide a minimum total thickness at any spot of 16 mils. Any spot having an excess of coal tar paint, here defined as more than 20 mils in a single coat or 35 mils in multiple coats must be repaired by sanding, grinding or abrasive blasting the excess material from the surface and reapplying the coatings to the above specified requirements. The specified film thickness must be attained in any event, and any additional (beyond two) coats needed to attain specified thickness must be applied at no additional cost to the Government.

#### 3.3.12 System No. 6-A-Z

Apply epoxy zinc-rich primer 19C in accordance with the manufacturer's directions in two single, half-lapped spray coats to an average dry film thickness of a minimum of 3.0 mils. The thickness at any spot must not be less than 2.5 mils or greater 6 mils for the primer. After a minimum drying period of 6 hours and no more than 96 hours, apply at least two coats of coal tar epoxy paint to provide a minimum thickness at any spot of 16 mils for the completed system. Any spot having an excess of coal tar paint, here defined as more than 20 mils in a single coat or 35 mils in multiple coats must be repaired by sanding, grinding or abrasive blasting the excess material from the surface and reapplying the coatings to the above specified requirements. If the epoxy zinc-rich paint has been applied in the shop or otherwise has been permitted to cure for longer than 96 hours, it must be abraded and recoated with an additional thin tack coat of the zinc-rich paint, which in turn must be overcoated within 96 hours with the first coat of coal tar-epoxy paint. The specified film thicknesses must be attained in any event, and any additional coats needed to attain specified thickness must be applied at no additional cost to the Government.

#### 3.3.13 System No. 7

Apply a special primer under the coal tar-based paint only if/as recommended by the coating manufacturer. The materials must be heavily applied by brush or with heavy-duty spray equipment at a coverage rate that

will give a minimum total dry film thickness of 20 mils at any spot for the completed system. The paint must not be thinned unless recommended by the manufacturer. If brushed, the final strokes must be at right angles to those of the preceding coat. Comply with the manufacturer's recommendations regarding the application and drying time between coats.

#### 3.3.14 System No. 8

Mix and apply the coating in accordance with the manufacturer's written instructions. The coating must be applied in one or more coats to achieve an average dry film thickness of a minimum of 12 mils. Minimum thickness at any spot must be not less than 9 mils. Roller application is preferred. Application to vertical surfaces by airless spray may be performed provided all condensed water droplets are removed by wiping with a terry cloth towel immediately prior to spray application. Application to horizontal surfaces or surfaces otherwise covered by standing or running water must be by roller. Brush application must be limited to inside corners, bolt heads and other surface irregularities that are difficult to coat by roller. Apply subsequent coats in the shortest recommended recoat interval. Comply with all manufacturer's recommendations regarding ambient and surface temperatures during application and curing of the coating.

#### 3.3.15 System No. 10

Apply the paint in accordance with the manufacturer's recommendations to a minimum average dry film thickness of 5 mils with a thickness at any spot of not less than 4.0 mils. The specified film thickness may be obtained in a single coat provided this is allowed by manufacturer's recommendations and provided this does not result in improper cure or result in the development of mud cracking or other film defects.

#### 3.3.16 System No. 12

Wash galvanized surfaces to expose damaged areas. Clean mars and breaks in the galvanized coating by hand or power tool to remove all corroded substrate. Touch up the damaged areas with two coats of SSPC Paint 20, Type II.

#### 3.3.17 System 16-A

Brush or spray the first coat in the shop or field as indicated. Touch up the coating in the field as necessary to maintain its integrity at all times. Apply the second and third coats in the field. Procure all materials from the same coating manufacturer and apply each coat in accordance with the manufacturer's written instructions. The finish color must be as indicated. Do not apply paint to running surfaces of bearings and machinery. Remove pipe-threading and cutting compounds by solvent washing prior to application of paint to pipe surfaces.

#### 3.3.18 System No. 17

Except as otherwise required, apply the same finish paint to all metal ductwork, conduit, pipe, radiators, grilles, louvers, pull boxes, and exposed surfaces of miscellaneous embedded metalwork as is applied to adjacent ceilings or walls provided that:

- a. The coat of MPI 50 may be omitted on metal surfaces primed with a shop or field coat of metal priming paint.

- b. On bare ferrous surfaces and wood replace the coat of MPI 50 with a coat of MPI 46.
- c. Solvent clean all galvanized and other nonferrous metal surfaces in accordance with SSPC SP 1 and prime with SSPC Paint 41 in place of the MPI 50 coat.

#### 3.3.19 System No. 18

Thin oil based alkyd paints using only odorless mineral spirits (ASTM D235 ). Except as otherwise required, finish all metal ductwork, conduit, pipe, radiators, grilles, louvers, pull boxes, and exposed surfaces of miscellaneous embedded metalwork the same as adjacent ceilings or walls provided that:

- a. The coat of MPI 46 or MPI 50 may be omitted on metal surfaces primed with a shop or field coat of metal priming paint.
  - b. Prime all bare ferrous surfaces with MPI 46.
  - c. Clean all galvanized and other nonferrous metal surfaces in accordance with SSPC SP 1 and prime with SSPC Paint 41 in place of MPI 46 or MPI 50.
- #### 3.3.20 System No. 21

Apply the paint in a minimum of two single coats to produce an average dry film thickness totaling 6.0 mils with no less than 5.0 mils at any spot. No individual coat may be more than 6.0 mils at any point. Apply MIL-DTL-24441 in compliance with the manufacturer's recommendations regarding type of thinner, amount of thinning, and required induction time. The drying time between coats must not be less than 8 hours nor more than 96 hours.

#### 3.3.21 System No. 21-A-Z

Apply the epoxy zinc-rich paint 19C in two single half-lapped spray coats to an average dry film thickness of a minimum of 3.0 mils and a thickness at any spot of not less than 2.5 mils or greater than 6.0 mils. After a drying period of not less than 6 hours or more than 96 hours, apply at least two coats of epoxy polyamide paint to produce an average dry film thickness totaling 12 mils and a thickness at any spot of not less than 10 mils. If the epoxy zinc-rich paint has been applied in the shop or otherwise has been permitted to cure for longer than 96 hours, it must be abraded and recoated with an additional thin tack coat of the zinc-rich paint, which in turn must be overcoated within 96 hours with the first coat of the epoxy polyamide paint. Apply MIL-DTL-24441 in accordance with the manufacturer's recommendations regarding type of thinner, amount of thinning, and required induction time. The drying time between non-zinc coats must not be less than 12 hours nor more than 96 hours..

#### 3.3.22 System No. 22

Apply the floor coating system MPI 212 in accordance with the manufacturer's written instructions. It must be a multi-coat system with the dry film thickness per coat as recommended by the manufacturer.

#### 3.3.23 System No. 23-A-Z

Apply the coating system in accordance with the manufacturer's written instructions. It must be a 3-coat system plus an additional stripe coat

applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. Application of the system in less than three coats will not be accepted. Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and passed all requirements of the applicable SSPC standards. **SSPC Paint 38** topcoat must meet the requirements of Accelerated Weathering Level 3. Apply the coatings by spray in accordance with the manufacturer's written instructions. Limited use of brush and roller application is permitted provided the specified film thicknesses are achieved. Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry film thickness per coat and minimum and maximum dry time between coats. Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

#### 3.3.24 System No. 23-B-Z

Apply the coating system in accordance with the manufacturer's written instructions. It must be a 3-coat system plus an additional stripe coat applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and passed all requirements of the applicable SSPC standards. **SSPC Paint 41** must be modified with coal tar pitch. Apply the coatings by spray in accordance with the manufacturer's written instructions. Limited use of brush and roller application is permitted provided the specified film thicknesses are achieved. Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry film thickness per coat and minimum and maximum dry time between coats. Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

#### 3.3.25 System No. 23-C-Z

Apply the coating system in accordance with the manufacturer's written instructions. It must be a 3-coat system plus an additional stripe coat applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and passed all requirements of the applicable standards. Apply the coatings by spray in accordance with the manufacturer's written instructions. Limited use of brush and roller application is permitted provided the specified film thicknesses are achieved. Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry film thickness per coat and minimum and maximum dry time between coats. Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

## 3.3.26 System No. 23-D

Apply the coating system in accordance with the manufacturer's written instructions. It must be a 3-coat system plus an additional stripe coat applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. The aluminum pigmented topcoat will not meet the SSPC Paint Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and passed all requirements of the applicable SSPC standards. [The first coat of the overcoat system must be applied by brush or roller to those areas where power tool cleaning exposed the steel substrate. The second coat of the overcoat system must also be applied by brush or roller to those areas that received a first coat of paint as well as any area where power tool cleaning or power washing removed the old topcoat. The final coat of the overcoat system must be applied to the entire surface by spray, brush, or roller.] [Application must be by spray. Limited use of brush and roller application is permitted provided the specified film thicknesses are achieved.] [Application must be by spray, brush, or roller.] Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry film thickness per coat and minimum and maximum dry time between coats. Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

## 3.3.27 System No. 23-E

Apply the coating system in accordance with the manufacturer's written instructions. It must be a 2-coat system. Application of the system in less than two coats will not be accepted. Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and passed all requirements of the applicable SSPC standards. Application must be by spray, brush, or roller in accordance with the manufacturer's written instructions. Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry film thickness per coat and minimum and maximum dry time between coats. Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

## 3.3.28 System No. 23-F-Z

Apply the coating system in accordance with the manufacturer's written instructions. It must be a 3-coat system plus an additional stripe coat applied by brush to all edges, corners, welds, fasteners, and other surface irregularities. Allow the stripe coat to dry as recommended by the manufacturer, prior to the application of the first full coat. Procure all materials from the same coating manufacturer. The individual paints comprising the system must have been tested and pass all of the requirements of the applicable SSPC standards. Apply the coatings by spray in accordance with the manufacturer's written instructions. Limited use of brush and roller application is permitted provided the specified film thicknesses are achieved. Comply with the manufacturer's recommendations regarding mixing and thinning requirements, and pot life requirements, dry



film thickness per coat and minimum and maximum dry time between coats. Do not use coating material that has thickened appreciably. Areas of bubbling noted upon curing of any individual coat must be removed by sanding or screening, the edges feathered, and the coat reapplied to the repaired areas before a subsequent coat is applied.

3.3.29 Protection of Nonpainted Items and Cleanup

Maintain walls, equipment, fixtures and all other items in the vicinity of the surfaces being painted free from damage by paint or painting activities. Promptly repair any paint spillage and painting activity damage.

3.4 INSPECTION

Surface preparation and painting inspections must be conducted by an inspector certified as meeting one of the following designations: SSPC-PCI Level 2, NACE-CIP Level 2. The inspector will inspect and document all work phases and operations on a daily basis and submit daily [Inspection Reports](#). As a minimum the daily report must contain the following:

- a. Inspections performed, including the area of the structure involved and the results of the inspection.
- b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.
- c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.
- d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

3.5 PAINTING SCHEDULES

SYSTEM NO. 1	
Items or surfaces to be coated:	[_____]
SURFACE PREPARATION	PAINT SYSTEM
Alternate 1: Power tool or brush-off blast cleaning	SSPC PS 26.00 Type II
Alternate 2: Commercial blast cleaning	SSPC PS 26.00 Type I

SYSTEM NO. 3				
Items or surfaces to be coated:		[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	White Vinyl V-766E (double spray coat)	Gray Vinyl V-766E (double spray coat)	Aluminum Vinyl V-102E (double spray coat)	Aluminum Vinyl V-102E (double spray coat)

SYSTEM NO. 3-A-Z				
Items or surfaces to be coated:		[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	Vinyl zinc-rich VZ-108D (double spray coat)	White Vinyl V-766E (double spray coat)	Aluminum Vinyl V-102E (double spray coat)	Aluminum Vinyl V-102E (double spray coat)

SYSTEM NO. 4					
Items or surfaces to be coated:			[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT	5th COAT
White metal blast cleaning	White Vinyl V-766E (double spray coat)	Gray Vinyl V-766E (double spray coat)	White Vinyl V-766E (double spray coat)	Gray Vinyl V-766E (double spray coat)	Gray Vinyl V-766E (double spray coat)

SYSTEM NO. 5-A-Z				
Items or surfaces to be coated:		[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	Vinyl zinc-rich VZ-108D (double spray coat)	White Vinyl V-766E (double spray coat)	Black Vinyl V-103C (double spray coat)	Black Vinyl V-103C (double spray coat)

SYSTEM NO. 5-C-Z				
Items or surfaces to be coated:		[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	Vinyl zinc-rich VZ-108D (double spray coat)	Dark Red Oxide Vinyl V-106D (double spray coat)	Light Red Oxide Vinyl V-106D (double spray coat)	Dark Red Oxide Vinyl V-106D (double spray coat)

SYSTEM NO. 5-D					
Items or surfaces to be coated:			[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT	5th COAT
White metal blast cleaning	Dark Red oxide Vinyl V-106D (double spray coat)	Light Red oxide Vinyl V-106D (double spray coat)	Dark Red oxide Vinyl V-106D (double spray coat)	Light Red oxide Vinyl V-106D (double spray coat)	Dark Red oxide Vinyl V-106D (double spray coat)

SYSTEM NO. 5-E-Z				
Items or surfaces to be coated:		[_____]		
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	Vinyl zinc-rich VZ-108D (double spray coat)	Gray Vinyl V-766E (double spray coat)	White Vinyl V-766E (double spray coat)	Gray Vinyl V-766E (double spray coat)

SYSTEM NO. 6			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
White metal blast cleaning	Coal tar epoxy C-200A (black)	Coal tar epoxy C-200A (black)	Coal tar epoxy C-200A (black) (if needed to attain required thickness)

SYSTEM NO. 6-A-Z			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st & 2nd COAT	3rd COAT	4th COAT
White metal blast cleaning	MIL-DTL-24441/19C	Coal tar epoxy C-200A (black)	Coal tar epoxy C-200A (black)

SYSTEM NO. 7			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Alternate 1: Power tool or brush-off blast cleaning	SSPC Paint 33	SSPC Paint 33	SSPC Paint 33

SYSTEM NO. 7			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Alternate 2: Commercial blast cleaning	SSPC Paint 33	SSPC Paint 33	SSPC Paint 33

SYSTEM NO. 8		
Items or surfaces to be coated:		[_____]
SURFACE PREPARATION	1st COAT	2nd COAT
White metal blast cleaning	Paint (for wet surfaces) CID A-A-3130	Additional coats as recommended by the manufacturer

SYSTEM NO. 10		
Items or surfaces to be coated:		[_____]
SURFACE PREPARATION	1st COAT	2nd COAT
White metal blast cleaning	SSPC Paint 20 Type I-B or I-C	SSPC Paint 20 Type I-B or I-C

SYSTEM NO. 12		
Items or surfaces to be coated:		[_____]
SURFACE PREPARATION	1st COAT	2nd COAT
Refer to paragraph SYSTEM NO. 12	SSPC Paint 20 Type II	SSPC Paint 20 Type II

SYSTEM NO. 16-A			
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
As specified for each type of surface	MPI 23	MPI 9	MPI 9

SYSTEM NO. 17			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
As specified for each type of surface	MPI 50	[MPI 114] [MPI 54] [MPI 52] [MPI 53]	[MPI 114] [MPI 54] [MPI 52] [MPI 53]

SYSTEM NO. 18			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
As specified for each type of surface	[MPI 46] [MPI 50]	[MPI 48] [MPI 47] [MPI 51] [MPI 49]	[MPI 48] [MPI 47] [MPI 51] [MPI 49]

SYSTEM NO. 21		
Items or surfaces to be coated:		[_____]
SURFACE PREPARATION	1st & 2nd COAT	3rd COAT
As specified for each type of surface	MIL-DTL-24441, Sheet [_____] , Color No. [_____]	as needed to obtain specified thickness

SYSTEM NO. 21-A-Z			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st & 2nd COAT	3rd & 4th COAT	5th COAT
As specified for each type of surface	MIL-DTL-24441/19C	MIL-DTL-24441, Sheet [_____] , Color No. [_____]	as needed to obtain specified thickness

SYSTEM NO. 22	
Items or surfaces to be coated:	[_____]
SURFACE PREPARATION	COATING SYSTEM
As specified by manufacturer	MPI 212

SYSTEM NO. 23-A-Z			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
White metal blast cleaning	SSPC Paint 40 Type II	SSPC Paint 41	SSPC Paint 38 Finish color: [_____]

SYSTEM NO. 23-B-Z			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
White metal blast cleaning	SSPC Paint 40 Type II	SSPC Paint 41 with coal tar pitch	SSPC Paint 41 with coal tar pitch

SYSTEM NO. 23-C-Z			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Commercial blast cleaning	SSPC Paint 40 Type II	MIL-PRF-85285 Type IV Finish color: [_____]	MIL-PRF-85285 Type IV Finish color: [_____] as necessary for complete hiding

SYSTEM NO. 23-D Alternate 1			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Power tool clean and power wash	SSPC Paint 41	SSPC Paint 41 Finish color: [_____]	SSPC Paint 41 Finish color: [_____]
SYSTEM NO. 23-D Alternate 2			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Power tool clean	SSPC Paint 41	SSPC Paint 41 Finish color: [_____]	SSPC Paint 41 Finish color: [_____]
SYSTEM NO. 23-D Alternate 3			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
SSPC SP 16	SSPC Paint 41	SSPC Paint 41 Finish color: [_____]	SSPC Paint 41 Finish color: [_____]

SYSTEM NO. 23-E		
Items or surfaces to be coated:	[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT
Alternate 1: Power tool clean	SSPC Paint 41	SSPC Paint 41 Finish color: [_____]
Alternate 2: Brush-off clean	SSPC Paint 41	SSPC Paint 41 Finish color: [_____]



SYSTEM NO. 23-F-Z			
Items or surfaces to be coated:		[_____]	
SURFACE PREPARATION	1st COAT	2nd COAT	3rd COAT
Commercial blast cleaning	SSPC Paint 40 Type II	SSPC Paint 41 with Aluminum	SSPC Paint 41 with Aluminum

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## SECTION 09 97 13.00 40

## STEEL COATINGS

11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

- ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants
- ASTM D4417 (2021) Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

## MASTER PAINTERS INSTITUTE (MPI)

- MPI 19 (2012) Primer, Zinc Rich, Inorganic

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC AB 1 (2015; E 2017) Mineral and Slag Abrasives
- SSPC AB 2 (2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
- SSPC AB 3 (2003; E 2004) Ferrous Metallic Abrasive
- SSPC PA 2 (2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
- SSPC SP 1 (2015) Solvent Cleaning
- SSPC SP 10/NACE No. 2 (2015) Near-White Blast Cleaning
- SSPC SP 11 (2020) Surface Preparation Standard No. 11 - Power Tool Cleaning to Bare Metal

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

- FED-STD-595 (Rev C; Notice 1) Colors Used in Government Procurement

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1910.134 Respiratory Protection
- 29 CFR 1910.1000 Air Contaminants

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Inspection Forms; G[, [\_\_\_\_]]

Safety Plan; G[, [\_\_\_\_]]

#### SD-03 Product Data

Abrasive Blasting Material; G[, [\_\_\_\_]]

Sealant Compound; G[, [\_\_\_\_]]

Inorganic Zinc; G[, [\_\_\_\_]]

Inhibitive Polyamide Epoxy; G[, [\_\_\_\_]]

Aliphatic Polyurethane; G[, [\_\_\_\_]]

#### SD-04 Samples

Manufacturer's Standard Color Charts; G[, [\_\_\_\_]]

Inspection Forms; G[, [\_\_\_\_]]

#### SD-05 Design Data

Inorganic Zinc; G[, [\_\_\_\_]]

Inhibitive Polyamide Epoxy; G[, [\_\_\_\_]]

Aliphatic Polyurethane; G[, [\_\_\_\_]]

#### SD-06 Test Reports

Inspection Reports; G[, [\_\_\_\_]]

#### SD-07 Certificates

Abrasive Blasting Material

Sealant Compound

Inhibitive Polyamide Epoxy

Aliphatic Polyurethane

#### SD-08 Manufacturer's Instructions

Protective Coatings

### 1.3 QUALITY CONTROL

Submit a [safety plan](#) for protective coating systems in accordance with OSHA regulations.

Submit [manufacturer's standard color charts](#) showing manufacturer's standard finish colors.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in their original, unopened containers bearing the manufacturer's name, date of manufacture, product identification, and batch number.

Store coatings, thinners, and cleaners in tightly closed containers in a covered, well-ventilated area; protected from exposure to extreme cold or heat, sparks, flame, direct sunlight, or rainfall. Follow manufacturer's instructions for storage limitations.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 [Abrasive Blasting Material](#)

Ensure that abrasive blasting materials conform to [SSPC AB 1](#), [SSPC AB 2](#), and [SSPC AB 3](#).

##### 2.1.2 [Sealant Compound](#)

Sealant is a self-curing, single-component, polysulfide-rubber, conforming to [ASTM C920](#). Provide a sealant gray in color and capable of being applied into the joint with a caulking gun.

##### 2.1.3 [Protective Coatings](#)

###### 2.1.3.1 Coating Systems

The following two coating system definitions are to be specified for use on the surfaces listed in the Coating Schedule of this section, and as directed.

Coating System No. 1 consists of [inorganic zinc](#) only [, no top coat unless specified]. Select inorganic zinc from [MPI 19](#). Ensure that coatings, thinners, and cleaners are the product of one manufacturer.

Coating System No. 2 consists of an inorganic zinc first coat, with an [inhibitive polyamide epoxy](#) intermediate coat, and an [aliphatic polyurethane](#) finish coat. Select coatings from the following listing. Ensure that all coatings, thinners, and cleaners are the product of the same manufacturer. Ensure that each successive coating is a contrasting color to provide a visual assurance of complete coverage.

[ Coating System No. 3 [\_\_\_\_\_]

]

COATING SYSTEMS			
<u>INORGANIC ZINC</u>	<u>INHIBITIVE POLYAMIDE EPOXY</u>	<u>ALIPHATIC POLYURETHANE</u>	<u>MANUFACTURER</u>
Dimetcote 9 Metalhide 1001	Amercoat 370	Amercoat 450HS	PPG One PPG Place Pittsburgh, PA 15272 412/434-3131
CarboZinc 11	Carboguard 893	Carbothane 134HS	Carboline Company 2150 Schuetz Road St. Louis, MO 63146 314-644-1000
CathaCoat 304V CathaCoat 304K CathaCoat 304L	Devran 201 H	Devthane 379	International Paint LLC/ Devoe Coatings 6001 Antoine Drive Houston, TX 77091 (713) 682-1711 (800) 654-2616
ZincClad II	Macropoxy 646-100	Hi-Solids Poly-CA	Sherwin-Williams Company 101 Prospect Avenue N.W. Cleveland, OH 44115 (800) 336-1110

### PART 3 EXECUTION

#### 3.1 PREPARATION

##### 3.1.1 Coating Hazards

Ensure that employees are trained in the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. Follow the coating manufacturer's written safety precautions throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents that exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134.

##### 3.1.2 Surface Preparation

For faying surfaces that become inaccessible after installation, abrasive-blast and coat with inorganic zinc only, before installation.

Clean surfaces that are part of slip-critical joints [according to SSPC SP10 (abrasive blasting) or SSPC SP 11 (power tool cleaning)] [according to SSPC SP10 (abrasive blasting) or SSPC SP 11 (power tool cleaning) and coated with MPI 19 (inorganic zinc)] before installation.

Do not apply coatings to areas to be welded. After welding is completed,

conduct the required surface preparation to the weld and any adjacent areas damaged by the welding operation, and feather in the required coating system.

Within 6 hours after completion of surface preparation and before rusting or recontamination occurs, clean prepared surfaces of abrasive residue, dust, and other contaminants and give the surface the first coat of paint. Re-prepare surfaces not coated within 6 hours or that show rusting or contamination, regardless of the length of time after preparation.

Sequence surface preparation and coating operations so that freshly applied coatings are not contaminated by dust or foreign matter.

Degrease surfaces as required in accordance with [SSPC SP 1](#) before surface preparation and the application of protective coatings. Degreasing is by solvent cleaning, detergent washing, or steam cleaning.

### 3.1.3 Abrasive Blasting (AB)

Dry abrasive blast all surfaces to be coated in accordance with the requirements of [SSPC SP 10/NACE No. 2](#). Round sharp edges of sheered members and remove weld slag, weld spatter, and foreign matter from surfaces to be coated prior to abrasive blasting. The blast profile, unless otherwise specified, is 1.5 to 2.5 mils as measured by [ASTM D4417](#), Method C. Use appropriate abrasive blast media to produce the desired surface profile and to give an angular anchor tooth pattern

Remove weld slag, weld spatter, and foreign matter from surfaces to be coated before abrasive blasting using mechanical methods as specified.

Remove all traces of abrasive residue and dust from the surface, leaving it clean and dry.

Surfaces not to be blasted are:

- a. Galvanized steel and non-ferrous or prefinished surfaces except when specified to be blast-cleaned in the coating schedule
- b. Piston rods and bearing surfaces
- c. [\_\_\_\_\_]

### 3.1.4 Power Tool Cleaning

Where specified, conduct power tool cleaning in accordance with the requirements of [SSPC SP 11](#).

## 3.2 APPLICATION

### 3.2.1 General Requirements

Manufacturer's instructions for thinning, mixing, handling, and applying products are considered a part of this specification. In the event of conflict between the requirements of this specification and the manufacturer's recommendations, this specification takes precedence.

Ensure that compressed air used for spraying coatings remains free of moisture and oil.

Ensure that each coat of applied material is free of runs; sags; blisters; bubbles; mud cracking; variations in color, gloss, and texture; holidays (missed areas); excessive film buildup; foreign contaminants; and dry overspray.

Do not apply coating when rain is imminent or when the temperature or humidity is outside the limits recommended by the coating manufacturer.

Ensure that the surface temperature is at least 5 degrees F above the dew point.

Apply coatings by airless or conventional spray. Use airless spray only for large, simply configured surfaces. Brush application is permitted only for striping and in areas that are otherwise inaccessible for spray application.

Protect newly coated surfaces from damage.

### 3.2.2 Mixing and Application Procedures

Mix multi-component paints according to the manufacturer's instructions. Use power agitation in a manner that does not introduce air into the mixed coating

Strain mixed material through a 30- to 60-mesh screen.

Continuously stir the inorganic zinc primer during application at a rate that will prevent the zinc from settling but will not introduce air into the material

Use brushes to work coatings thoroughly into joints, rough welds, crevices and around rivets and bolts. Pay special attention to cutouts, sharp edges, and irregular surfaces to ensure complete coverage and recommended thickness.

Measure the final dry film thickness after each coat in accordance with **SSPC PA 2**. Make all measurements with a Type 2 gauge having an accuracy of 3 percent or better. Ensure the coating measurements meet the Level 1 thickness restrictions and are in compliance with the manufacturer's recommended minimum and maximum requirements. Repair areas of non-compliance by adding additional paint or mechanically removing the excess paint prior to the application of the succeeding coat.

### 3.2.3 Coating Systems

#### Coating System No. 1:

Inorganic zinc primer: [ 2.5 to 4 mils] [3 to 6 mils,] inorganic zinc, as specified in Coating Schedule.

#### Coating System No. 2:

- a. Inorganic zinc primer: [ 2.5 to 4 mils] [3 to 6 mils,] inorganic zinc, as specified in Coating Schedule.
- b. Inhibitive polyamide epoxy, second coat: 2 to 4 mils. [ Top coat [\_\_\_\_\_] 2 to 4 mils.]
- c. Aliphatic polyurethane, third coat: 2 to 4 mils, but sufficient to



hide previous coat [Second coat, inorganic zinc, 2 to 4 mils.]

[ Coating System No. 3: [\_\_\_\_\_] ]

#### ]3.2.4 Touch-Up

Touch up abrasions that occurred during shipment or erection as follows:

- a. If the substrate is showing any corrosion, the restore the required surface profile by spot blasting, and the entire coating system replaced at that location
- b. If the substrate is not corroding, prepare and coat the area in accordance with the manufacturer's guidance, feathering each coat into the existing coat to provide a smooth appearance.
- c. Use inhibitive polyamide epoxy and aliphatic polyurethane for touch-up and repair of Coating System No. 2.

#### 3.2.5 Sealant Compound Application

For Coating System No. 1, proceed with caulking after application and cure of inorganic zinc coating.

For Coating System No. 2, proceed with caulking after application and cure of inhibitive epoxy coat and before aliphatic polyurethane coat.

Caulk exterior joints, including, but not limited to, the following:

- a. Perimeter of faying and bearing surfaces of structural members
- b. Joints in members between intermittent welds
- c. Perimeter of bearing surfaces between floor plates and supporting members (inside, outside, top, and bottom)
- d. Stair treads, where joined to channel stringers
- e. Openings of 1/2 inch or smaller (Use foam filler backup as required.)
- f. Hot-dipped galvanized vent holes

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Inspection

##### 3.3.1.1 Inspection Forms

At the pre-work conference, provide sample [inspection forms](#) to be completed by the Coating Inspector and submitted to the Contracting Officer.

##### 3.3.1.2 Coating Inspector

Work is inspected for compliance by a [Contracting Officer] [Contractor] provided [NACE CIP Level 2 inspector] [SPCC PCI Level 2 inspector] [\_\_\_\_\_] . Submit the completed Coating Inspector [inspection reports](#) [\_\_\_\_\_] [every week] [at the completion of the project].

For all protective coatings applied at off-site locations, provide full

inspection by a NACE certified Coating Inspector. Ensure that the inspector is present at the prework conference to address necessary clarification of inspection and specification requirements. Report immediately any apparent deviation from the specified requirements or any out-of-tolerance condition to the Contracting Officer for determination of corrective action.

3.4 SCHEDULES

3.4.1 Coating Schedule

SURFACE DESCRIPTION	SURFACE PREPARATION	FIRST COAT	SECOND COAT	THIRD COAT
Items or surfaces to be coated: [_____]	Near white metal blast cleaning	MPI #19	MPI #108 Finish Color: [_____]	MPI #72 Finish Color: [_____]
Items or surfaces to be coated: [_____]	Near white metal blast cleaning	MPI #19	[_____]	[_____]

Finish color as according to [FED-STD-595](#).

-- End of Section --

## SECTION 09 97 13.16

## INTERIOR COATING OF WELDED STEEL WATER TANKS

05/11, CHG 2: 08/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

- ASTM D3276 (2015; E 2016) Standard Guide for Painting Inspectors (Metal Substrates)
- ASTM D3925 (2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
- ASTM D4285 (1983; R 2018) Indicating Oil or Water in Compressed Air
- ASTM D7127 (2017) Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces using a Portable Stylus Instrument

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 9001 (2015) Quality Management Systems- Requirements

## NACE INTERNATIONAL (NACE)

- NACE SP0188 (1999; R 2006) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

## NSF INTERNATIONAL (NSF)

- NSF/ANSI 61 (2020) Drinking Water System Components - Health Effects

## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC 7/NACE No.4 (2007) Brush-Off Blast Cleaning
- SSPC AB 2 (2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
- SSPC AB 3 (2003; E 2004) Ferrous Metallic Abrasive
- SSPC Guide 12 (1998; E 2004) Guide for Illumination of Industrial Painting Projects
- SSPC PA 1 (2016) Shop, Field, and Maintenance Coating of Metals

SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC QP 5	(2012) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC SP COM	(2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

## SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement
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## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(1993; Rev B; Am 1 1994; Am 2 1996; Notice 1 2021) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/20	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III
MIL-DTL-24441/22	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White Formula 152, Type III
MIL-DTL-24441/29	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type IV
MIL-DTL-24441/31	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type

## IV

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1926.59	Hazard Communication

## 1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the paragraph where used, and denoted by capital letters. The following definitions are used throughout this Section:

- a. CEILING - interior tank surfaces that extend from the horizontal plane at the designated maximum water line upward, including the upper portion of the tank shell (walls), columns, structural steel, the underside of the roof plates and other steel components in this area.
- b. BOWL - interior tank surfaces that extend from the horizontal plane at the designated maximum water line downward, including the tank walls, columns, piping, pipe supports, bottom plates, and other steel components in this area.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-05, Design Data

Environmental Control System

## SD-06 Test Reports

Metallic Abrasive Qualification Test Reports

Coating Sample Test Reports

Abrasive Sample Test Reports

Inspection Report Forms

Daily Inspection Reports

Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

## SD-07 Certificates

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Coating Work Plan

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications Of Individuals Performing Abrasive Blasting

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coating Inspection Company

Qualifications of QC Specialist Coating Inspector

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Qualifications of Coating Contractors

Roof Joint Sealant Materials

Roof Joint Sealant Compatibility

Epoxy Coating Materials

Non-metallic Abrasive

Metallic Abrasive

SD-08 Manufacturer's Instructions

Roof Joint Sealant Instructions

Coating System Instructions

SD-11 Closeout Submittals

Disposal of Used Abrasive; G[, [\_\_\_\_\_]]

Inspection Logbook; G[, [\_\_\_\_\_]]

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the Coating Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution. Schedule time (Float) should be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

##### 1.4.2 Corrective Action (CA)

CA shall be included in the Quality Control Plan.

#### 1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated. Develop Corrective Action Request (CAR) forms for initiating CA, and for tracking and documenting each step.

#### 1.4.2.2 Implement Corrective Action

The Contractor shall take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These procedures shall apply to non-compliance in the work, and to non-compliance in the QC System. Corrective actions shall be appropriate to the effects of the non-compliance encountered. Each CAR shall be serialized, tracked in a Log to completion and acceptance by the Contracting Officer, and retained in project records. The Corrective Action Log, showing status of each CAR, shall be submitted to the Contracting Officer monthly. A CAR may be initiated by either the Contractor or the Contracting Officer. The Contracting Officer must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

#### 1.4.3 Coating Work Plan

This work plan shall be considered as part of the Quality Control Plan.

Provide procedures for reviewing contract documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.

Provide procedures for verification of key processes during Initial Phase to ensure that contract requirements can be met. Key processes shall include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.

Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of non-compliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.

[ Provide procedures for determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.

] Provide procedures for correcting non-compliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well

as to avoid delays in production. Provide procedures for repairing defects in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to correct coating thickness non-compliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.

If a procedure is based on a proposed or approved request for deviation, the deviation shall be referenced. Changes to procedures shall be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

#### 1.4.4 Design Data

##### 1.4.4.1 Environmental Control System

Submit design details of the proposed environmental control system to include ventilation, humidity control, and temperature regulation. Provide calculations for humidity control during separate surface preparation and coating application procedures, ventilation requirements during coating application, and maximum allowable coating application rates to coincide with ventilation. Include basis of design data on local conditions. Provide equipment layout sketches and procedures showing function of each piece of equipment and fail-safe measures. A Certified Industrial Hygienist shall approve calculations, work procedures and personal protective equipment.

#### 1.4.5 Test Reports

##### 1.4.5.1 Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of **SSPC AB 3**. Submit test results from independent laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of prequalifying the abrasive.

##### 1.4.5.2 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by **SSPC AB 2**, as modified in paragraph ABRASIVE.

#### 1.4.6 Qualifications

##### 1.4.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.4.6.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party PCS. Submit documentation that specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification.



If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS shall remain certified during the entire project, and the Contracting Officer shall be notified of any change in certification status within 10 days of the change. The PCS shall not be the designated coating inspector.

#### 1.4.6.3 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by SSPC to the requirements of **SSPC QP 5** prior to contract award, and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

#### 1.4.6.4 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to **SSPC QP 5**, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

#### 1.4.6.5 Qualifications Of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by SSPC to the SSPC C-7 Dry Abrasive Blaster Qualification Program. Each blaster shall remain qualified during the entire period of abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status.

#### 1.4.6.6 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified.

#### 1.4.6.7 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that employees performing testing are qualified.

#### 1.4.6.8 Qualifications of Coating Contractors

All Contractors and Subcontractors that perform surface preparation or

coating application shall be certified to either ISO 9001 or SSPC QP 1 and SSPC QS 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting Contractors and painting Subcontractors must remain so certified for the duration of the project. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status.

#### 1.4.6.9 Roof Joint Sealant Materials

Provide manufacturer's certification of conformance to contract requirements[, and is certified in accordance with NSF/ANSI 61].

#### 1.4.6.10 Roof Joint Sealant Compatibility

Provide manufacturer's certification that the selected joint sealant is compatible with the epoxy primer and is suitable for application directly to prepared steel surfaces.

#### 1.4.6.11 Epoxy Coating Materials

Provide manufacturer's certification that the epoxy lining materials are [currently approved by the Naval Sea Systems Command and listed on the Qualified Products Lists (QPL) for the specified materials][certified in accordance with NSF/ANSI 61 for tanks of the size being coated].

#### 1.4.6.12 Non-metallic Abrasive

Provide manufacturer's certification that the materials are currently approved by the Naval Sea Systems Command and listed on the Qualified Products Lists (QPL) for the specified materials.

#### 1.4.6.13 Metallic Abrasive

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results.

#### 1.4.7 Protective Coating Specialist (PCS)

The PCS shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The PCS shall approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

#### 1.4.8 Pre-Application Meeting

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, coating inspector, and PCS shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: corrective action requirements and procedures, coating work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least

ten days prior to meeting.

## 1.5 PRODUCT DATA

### 1.5.1 Roof Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

### 1.5.2 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

## 1.6 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 40 and 75 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer. Expired materials may be returned to manufacturer, tested, and if compliant, issued a shelf life extension.

If materials are approaching shelf life expiration and an extension is desired, samples may be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer may issue an extension, referencing the product evaluation and the review of storage records. Products may not be extended longer than allowed in the product specification.

## 1.7 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

## 1.8 WORK SEQUENCE

Coat tank interior following leak testing.

## 1.9 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D3276, ASTM D3925, ASTM D4285, ASTM D7127, NACE SP0188, SSPC SP COM, SSPC SP 1, SSPC 7/NACE No.4, SSPC SP 10/NACE No. 2, SSPC PA 1, SSPC PA 2,

SSPC Guide 12, SSPC VIS 1, , SSPC QP 1, SSPC QS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

## PART 2 PRODUCTS

### 2.1 ROOF JOINT SEALANT

Industrial grade, two component, minimum 95 percent solids by volume, polysulfide type caulking material that has a minimum history of 10 years acceptable service in water tanks. Sealant shall be compatible with the epoxy primer and suitable for direct application to prepared steel surfaces. Sealant shall contain no more than 0.06 percent by dry weight Lead, no more than 0.06 percent by dry weight Cadmium, and no more than 0.00 percent by dry weight Chromium. [ Sealant shall be certified in accordance with NSF/ANSI 61.]

### 2.2 COATING SYSTEM

Alternate systems or products will not be considered. All primer, intermediate, and topcoat materials shall be manufactured by one manufacturer. [The entire coating system is intended to be applied in the field. Alternatively, surface preparation may be accomplished in the shop, following all temperature, humidity, and testing requirements listed herein, followed by an application of a hold-primer. Upon completion of field fabrication, all shop-applied coatings shall be removed, surfaces prepared to SSPC SP 10/NACE No. 2, and the specified coating system applied. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.]

#### [2.2.1 NSF Certified Polyamide Epoxy Coating System

Select a commercially available, three coat polyamide epoxy coating system that is certified in accordance with NSF/ANSI 61 for contact with potable water in water storage tanks of the size being coated. The coating system shall be suitable for application in three even coats of 3-5 mils dry film thickness (DFT), for a total minimum of 9 mils DFT.

#### ] 2.2.2 MIL-DTL-24441 Epoxy System for Potable Water Tanks

The epoxy coating materials shall be approved by the Naval Sea Systems Command and listed on their current Qualified Products List (QPL) for the specified materials.

##### 2.2.2.1 Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/20 (Formula 150, Type III, Green).

##### 2.2.2.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/22 (Formula 152, Type III, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

##### 2.2.2.3 Epoxy Topcoat

Epoxy polyamide, MIL-DTL-24441/22 (Formula 152, Type III, White).

## ] 2.2.3 MIL-DTL-24441 Epoxy System for Non-potable Water Tanks

The epoxy coating materials shall be approved by the Naval Sea Systems Command and listed on their current Qualified Products List (QPL) for the specified materials.

## 2.2.3.1 Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/29 (Formula 150, Type IV, Green).

## 2.2.3.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

## 2.2.3.3 Epoxy Topcoat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White). All other requirements of this Military Specification apply.

## ] 2.3 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled[, a shipping box sized for the samples to to be shipped, and packing material]. Mark cans for the appropriate component. [ Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.]

## 2.4 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

## 2.5 TEST KITS

## 2.5.1 Test Kit for Measuring Chloride, Sulfate and Nitrate Ions on Steel and Coated Surfaces

Provide test kits called CHLOR\*TEST CSN Salts, as manufactured by CHLOR\*RID International Inc. of Chandler, Arizona ([www.chlor-rid.com](http://www.chlor-rid.com)) or equal. An "equal" test kit shall meet the following requirements:

- a. Kit contains all materials, supplies, tools and instructions for field testing and on-site quantitative evaluation of chloride, sulfate and nitrate ions;
- b. Kit extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;
- c. Kit components and solutions are mercury free and environmentally friendly;

- d. Kit contains new materials and solutions for each test extraction;
- e. Extraction test container (vessel, sleeve, cell. etc.) creates a sealed, encapsulated environment during salt ion extraction;
- f. Test extract container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;
- g. All salt ion concentrations are directly measured in micrograms per square centimeter.

#### 2.5.2 Test Kit for Identifying Amine Blush on Epoxy Surfaces

After coating and/or primer has hardened and prior to applying the next coat, test for unreacted amines using the AMINE BLUSH CHECK, manufactured by Elcometer, Rochester Hills, Michigan, or equal. To be considered for approval as an "equal" test kit it shall meet the following requirements:

- a. Be a completely self-contained field test kit with all materials, supplies, tools and instructions to perform tests and indicate the presence of unreacted amines;
- b. Use an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;
- c. Kit contains no mercury or lead and is environmentally friendly;
- d. Kit contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution;

#### 2.6 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

[ Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.  
]

##### 2.6.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials) [ except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Abrasive shall be approved by the Naval Sea Systems Command and listed on the appropriate Qualified Products List (QPL) for the specified materials. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive.

Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

## 2.6.2 Metallic Abrasive

### 2.6.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of **SSPC AB 3** Class 1 (Steel) only[, except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Class 2 (Iron) abrasive shall not be used.

To develop a suitable work mix from new steel abrasive, a minimum of 200 - 400 recycles is required, therefore, it is advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project. Such grit shall be considered to conform if it can be traced to new grit conforming to **SSPC AB 3** Class 1 and it meets all cleanliness requirements of **SSPC AB 3** Class 1 when brought to the current jobsite. Submit one representative sample of this work mix to the laboratory for testing, along with samples of new material. Acceptance and use of this work mix shall not be used to justify any deviation from surface preparation requirements.

### 2.6.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of **SSPC AB 2**

## PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coating Work Plan.

### [3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section **02 83 00 LEAD REMEDIATION**. Coordinate surface preparation requirements from Section **02 83 00 LEAD REMEDIATION** with this Section.

### ]3.2 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite. Notify Contracting Officer three days in advance of sampling. The QC Manager, and either the PCS or coating inspector, shall witness all sampling.

#### 3.2.1 Coating Sample Collection

Provide a sample collection kit as required in paragraph COATING SAMPLE COLLECTION AND SHIPPING KIT. From each lot, obtain a one quart sample of each batch of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with **ASTM D3925**. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered

for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. [ The QC Manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph entitled "Coating Sample Test Reports." ]

### 3.2.2 Abrasive Sample Collection

Provide suitably sized containers for each sample to be taken. Provide a sample collection kit as required in paragraph ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT. For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC Manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph ABRASIVE SAMPLE TEST REPORTS.

### [3.2.3 Coating Sample Test Reports

Submit test results for each lot of coating material delivered to the jobsite. Test samples of primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

### ]3.2.4 Abrasive Sample Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of metallic abrasive to the requirements of paragraph REQUIREMENTS of SSPC AB 3, except paragraph 4.1.5 DURABILITY. Test samples of non-metallic abrasive as required in paragraph QUALITY CONFORMANCE INSPECTION of MIL-A-22262. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

### [3.3 SLUDGE REMOVAL AND TANK CLEANING

Remove sludge and clean storage tanks in accordance with [\_\_\_\_\_].

### ]3.4 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

### 3.5 ENVIRONMENTAL CONDITIONS

#### 3.5.1 Control System Requirements

Provide and utilize dehumidification and ventilation equipment to control humidity, temperature, and vapor levels in tank from beginning of abrasive blasting through coating application and for four days after the last coating is applied. System shall maintain vapor concentrations at or below



10 percent of Lower Explosive Limit (LEL). System may incorporate any combination of solid desiccant and direct expansion refrigeration equipment. No liquid, granular, calcium chloride, or lithium chloride drying systems will be accepted. Use only electric, indirect fired combustion, indirect friction, or steam coil auxiliary heaters. System shall be compatible with removal of dust and solvent vapors, and shall have fail-safe measures to ensure reliability during operations.

### 3.5.2 Automated Monitoring Requirements

Provide continuous monitoring of DH equipment, and temperature, relative humidity, and dew point data at pertinent points on the structure, during surface preparation, coating application, and initial cure. Locate sensors to provide pertinent data for the surface preparation and coat application being performed. Make data available to the Contracting Officer through Internet access. Provide monitoring equipment to perform as follows:

- a. Data is collected in the field unit in one minute increments, and available for download (on-site) in a standard format. Contractor shall collect this data and make available to the Contracting Officer;
- b. Monitoring equipment shall have backup power such that data collection and transmission to web server will be uninterrupted during the entire period of the dehumidification requirement;
- c. Monitoring equipment shall have capability to measure surface temperatures at a minimum of four locations anywhere on a 150 foot diameter by 50 foot high tank;
- d. Monitoring equipment shall have capability to measure interior and exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP);
- e. Data shall be available continuously through secure internet connection, using widely available web browsers;
- f. Internet accessible data shall be collected and stored in maximum 15 minute increments, and lag time between data collection and online availability shall be no greater than 70 minutes;
- g. Internet accessible data shall be available for viewing online in tabular format, and graphical format using selected data;
- h. Internet accessible data shall be available for download in user-defined segments, or entire project to date, in a standard format usable by Microsoft Excel and other spreadsheet programs.
- i. Internet-based controls shall provide alerts to pre-designated parties through email messaging;
- j. Internet-based controls shall monitor data uploads from field unit and issue alert if data not initiated within 60 minutes of last upload;
- k. Internet-based controls shall monitor operation of DH equipment and issues alert when power remains off for more than 15 seconds, or if pre-determined temperature, RH, or DP conditions are exceeded;

The requirements listed here were developed around the Munters Exactaire Monitoring System, as this was the only monitoring system having Internet

connectivity known to be commercially available. There is no requirement for connectivity of the monitoring system to control the DH equipment, therefore, any combination of equipment having the required functionality will be accepted.

### 3.5.3 Humidity Control for Surface Preparation and Primer Application

Provide and utilize dehumidification equipment to maintain relative humidity at appropriate level to prevent prepared steel surfaces from corroding at all times during abrasive blasting through primer application. Failure of humidity control system, or failure to maintain proper conditions, during surface preparation stage may allow surface rusting, which will be rejected and require rework. All surfaces to be coated must meet all requirements at time of primer application. Failure of humidity control system during primer application stage will be cause for removal and replacement of all materials applied and cured while conditions were not as prescribed above.

### 3.5.4 Humidity Control for Application of Intermediate and Topcoats and Initial Curing

Provide and utilize dehumidification equipment to maintain relative humidity at the coldest steel surface in tank below 55 percent at all times during coating application, and during the first four days of initial curing after application of topcoat. This measurement is not the same as measuring the relative humidity of ambient air in the tank, and will require either electronic equipment to monitor relative humidity at the steel surface, or complex calculations to convert relative humidity of air in tank to relative humidity at steel surface. An approved alternative method of monitoring dehumidification that requires less sophisticated equipment or calculations is to maintain a minimum dew point depression of 18 degrees F below coldest steel surface temperature. This is in lieu of specific relative humidity and dew point requirements in this Section. Failure to maintain specified humidity control during this phase will be cause for extension of humidity controlled cure time to ensure four consecutive days at specified relative humidity at steel surfaces. Formation of condensation in coating application stage prior to the indicated dry-hard time will be cause for removal and replacement of all materials contacted by condensation.

## 3.6 EQUIPMENT USED IN TANK

Equipment used in the tank after surface preparation begins shall not leave any oily residue from exhaust or other sources. Internal combustion driven equipment, other than that powered by natural or bottled gas, shall not be used.

## 3.7 SURFACES TO BE COATED

Prepare and coat interior tank surfaces, including[ CEILING] [, BOWL] [spot repair of [\_\_\_\_\_] spots of [\_\_\_\_\_] square feet] [\_\_\_\_\_] .

## 3.8 SURFACE PREPARATION

### 3.8.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when

tested in accordance with [ASTM D4285](#). Test air quality at each startup, but in no case less often than every five operating hours.

### 3.8.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required by the appropriate abrasive specification daily at startup and every five operating hours thereafter.

### 3.8.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more 1 foot square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with [ASTM D7127](#). When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

### 3.8.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

#### 3.8.4.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) BLACK LIGHT TEST, and 4) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean [using a water based pH neutral degreaser ]in accordance with [SSPC SP 1](#), and recheck for contamination until surfaces are free of oil and grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

BLACK LIGHT TEST - Inspect surfaces for oil and grease contamination using the light specified in the paragraph BLACK LIGHT. Use light no more than 15 inches from surface unless testing indicates that the specific oil or grease found in tank fluoresce at a greater distance. Use light in tank that is completely sealed from light infiltration, under a hood, or at night. Any fluorescing on steel surfaces is indication of petroleum oil/grease contamination. Use either WATER BREAK TEST or CLOTH RUB TEST to confirm both contaminated and non-contaminated areas detected by BLACK LIGHT TEST. The BLACK LIGHT TEST may not be used during inspection of prepared surfaces for oil and grease contamination unless proven to fluoresce the oil and/or grease found in the specific tank and documented during testing prior to abrasive blasting. Generally, only petroleum oil/grease will fluoresce, however, some may not fluoresce sufficiently to be recognized and other methods, such as the WATER BREAK TEST or CLOTH RUB TEST, must be used to confirm findings of the BLACK LIGHT TEST.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease

contamination.

#### 3.8.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

#### 3.8.5 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with [SSPC SP 10/NACE No. 2](#). Prepared surfaces shall conform to [SSPC VIS 1](#) and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with [ASTM D7127](#), using Rmax as the measure of profile height. Record all measurements required in this standard. Measure profile at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. When surfaces are reblasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Do not attempt to wipe surface clean.

#### 3.8.6 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with Federal, State and Local mandated regulations.

#### 3.8.7 Pre-Application Testing For Surface Contamination

##### 3.8.7.1 Pre-Application Testing for Oil and Grease Contamination

Ensure tank surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION.

##### 3.8.7.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in paragraph TEST KIT FOR MEASURING CHLORIDE, SULFATE AND NITRATE IONS ON STEEL AND COATED SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. [Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting. ] [Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and

vertical welds. ]One or more readings greater than nondetectable for chlorides, sulfates, or nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as discussed in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION, allow to dry, and re-test until all required tests show allowable results. Reblast tested areas using vacuum equipped blast equipment. Label all test tubes and retain for test verification.

### 3.8.7.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces, clean by vacuum cleaning, and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

## 3.9 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

### 3.9.1 Preparation of Sealant and Coating Materials for Application

Each of the different products, sealant, primer, intermediate, and topcoat, is a two-component material supplied in separate containers.

#### 3.9.1.1 Mixing

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time based on its temperature.

#### 3.9.1.2 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Do not add solvent to extend pot life. Add all required solvent at time of mixing. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop, it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. In hot climates, precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F will extend pot life. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy Primer and Intermediate Coat Materials	4 hours

#### 3.9.1.3 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and

condensation conditions are met. If conditions do not allow for orderly application of sealant, primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature between 60 and 100 degrees F during application and the first four hours of cure for epoxy coats. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coat during appropriate RECOAT WINDOW of preceding coat. If a RECOAT WINDOW is missed, the minimum and maximum primer and intermediate coat thickness may be adjusted to accommodate a FILL COAT, however, requirements for total epoxy coating thickness and total coating thickness will not be modified. Missing more than one RECOAT WINDOW may require complete removal of coating if maximum total coating thickness requirements cannot be achieved.

If coating is not applied during RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, provide GLOSS REMOVAL, apply next coat within 24 hours. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as non-compliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT.

RECOAT WINDOWS						
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	8-18

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 2 to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.

GLOSS REMOVAL - Where required, hand sand in a linear fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer coat is to scarify surface and shall consist of removal of approximately 1 mil of coating. If steel is exposed during GLOSS REMOVAL, repair in accordance with paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of intermediate coat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

### 3.9.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of roof joint sealant, epoxy coat, or polyurethane topcoat for amine blush contamination using the Test Kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. If one or more tests show positive results for amine blush contamination, either treat all surfaces using the approved amine blush removal procedure or increase testing to ensure that all contamination is located, and then treat identified contamination using the approved procedure.

### 3.9.3 Application of Coating System and Roof Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply sealant and coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION, as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and the quality of air entering tank is controlled. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. For convenience, stripe coat material may be delivered by spray if followed immediately with brush-out and approved procedures include appropriate controls on thickness. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond [ 15] [\_\_\_\_\_] feet from the tank perimeter] [the tank berm]. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of portable shelters or other appropriate controls.

Apply coatings at the following specified thickness:

<u>Coat</u>	<u>Minimum DFT</u> <u>(Mils)</u>	<u>Maximum DFT</u> <u>(Mils)</u>
Primer	3	5
Intermediate	3	5
Top	3	5

<u>Coat</u>	<u>Minimum DFT (Mils)</u>	<u>Maximum DFT (Mils)</u>
Total system	9	15

Measure coating thickness in accordance with [SSPC PA 2](#) to confirm that coating application is within the specified range and within the tolerances of that standard. For non-compliant areas, increase number of test areas to identify all non-compliant application as required by [SSPC PA 2](#). Add coating as required to correct underruns, and remove coating with excess thickness to bare steel and reapply as specified in paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING.

#### 3.9.3.1 Application of Roof Joint Sealant

Apply sealant to the roof-to-shell joint, to all roof plate lap joints, and to roof-to-rafter joints up to [1 inch](#) gap to exclude moisture from these marginally prepared crevice areas. Allow sealant to cure according to manufacturer's instructions prior to application of the stripe coat.

#### 3.9.3.2 Application of Stripe Coat

Apply stripe coat of epoxy primer material prior to application of general primer coat on CEILING. Apply stripe coat of epoxy intermediate coat material after application of general primer coat on BOWL. Where stripe coat is applied to areas of joint sealant, allow appropriate curing time for joint sealant. Apply stripe coat by brush, working the material into corners, crevices, pitted areas, and welds, and onto outside corners and angles. Where roof-to-rafter joints exceed [1 inch](#) gap and roof joint sealant was not applied, use appropriate application tools to provide "best effort" coating of all exposed steel surfaces in the gap. Mini-rollers or other tools may be required.

#### 3.9.3.3 Application of Primer

Apply primer coat within RECOAT WINDOW of stripe coat.

#### 3.9.3.4 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

#### 3.9.3.5 Application of Topcoat

Apply topcoat within RECOAT WINDOW of intermediate coat.

#### 3.9.4 Holiday Testing

No sooner than 48 hours after application of the topcoat, perform holiday testing in accordance with the low voltage wet sponge method of [NACE SP0188](#). Repair holidays per paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating."

#### 3.9.5 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with [SSPC SP 10/NACE No. 2](#), and feather coating as required to leave [4 inches](#) of each succeeding coat



feathered and abraded. Do not abrade the polyurethane topcoat. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceding coat. Within four hours of preparation, apply primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system. If one percent or more of the total surface area, or more than one spot per 2000 square feet, of the BOWL area requires repair to any coat or coats, including feathered areas, the entire BOWL coating system shall be removed and reapplied. If 5 percent or more of the total surface area, or more than one spot per 1000 square feet, of the CEILING area requires repair to any coat or coats, including feathered areas, the entire CEILING coating system shall be removed and reapplied.

### 3.9.6 Tank Occupancy After Coating Application

Use clean canvas, or other approved, shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

### 3.9.7 Extended Cure of Coating System Prior to Immersion Service

Allow a cure time of at least 14 days after the final coating material has been applied before introducing water into tank.

## 3.10 PROJECT IDENTIFICATION

At the completion of the tank work, stencil coating information on the exterior of the tank adjacent to the main manway opening[, and adjacent to the access ladder on the lower portion of the leg for an elevated tank. Information should be easily accessible from the ground, and if there is not room on the leg to place the information, place it on the riser, facing the access ladder]. Stenciling shall be in 3/4 to one inch Helvetica style letters of contrasting color using acrylic stencil paint:

Date Interior coated:

Project Number:

Contractor:

Address:

Coating System

Surface Prep: SSPC SP \_\_\_\_\_ Profile: \_\_\_\_\_

Primer: \_\_\_\_\_ Thickness: \_\_\_\_\_

Intermediate: \_\_\_\_\_ Thickness: \_\_\_\_\_

Topcoat: \_\_\_\_\_ Thickness: \_\_\_\_\_

Total Thickness: \_\_\_\_\_

## 3.11 FIELD QUALITY CONTROL

Project documentation, including inspection and testing records, shall be used to determine the Contractor's compliance with contract requirements and approved procedures. The Contractor's certifications of completion, for both invoices and for project completion, shall be based on documented evidence of compliance with all requirements and approved Coating Work Plan procedures. Track inspections and tests in the Test Plan & Log.

### 3.11.1 Coating Inspector

The coating inspector shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting requirements specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL.

### 3.11.2 Field Inspection

#### 3.11.2.1 Inspection Requirements

Perform field inspection in accordance with ASTM D3276 and the approved Coating Work Plan. Document Contractor's compliance with the approved Coating Work Plan.

Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:

- a. Location or area;
- b. Purpose (required or special);
- c. Method;
- d. Criteria for evaluation;
- e. Results;
- f. Determination of compliance;
- g. List of required rework;
- h. Observations.

Collect and record Environmental Conditions as described in ASTM D3276 on a 24 hour basis, as follows:

- a. During surface preparation, every two hours or when changes occur;
- b. During coating application and the first four days of initial cure, every hour, or when changes occur;
- c. Note location, time, and temperature of the highest and lowest surface temperatures each day;
- d. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

NOTE: Data collected on Environmental conditions in paragraph AUTOMATED MONITORING REQUIREMENTS may be used for overnight data, however, the data must be constantly verified as to location of sensors and validity of data with respect to the coating work being accomplished.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed. Work documented using data from equipment found to be out of calibration shall

be considered as non-compliant since last calibration or calibration check, as required.

#### 3.11.2.2 Inspection Report Forms

Develop project-specific report forms as required to report measurement and test results and observations being complete and compliant with contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of compliance of each inspected item. Annotation of non-compliance shall be conspicuous so as to facilitate identification and transfer to the Rework Log. Report forms shall include requirements and acceptance and rejection criteria, and shall be legible and presented so that entered data can be quickly compared to the appropriate requirement.

#### 3.11.2.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. Each report shall be signed by the coating inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

#### 3.11.2.4 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

#### 3.11.3 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

##### 3.11.3.1 Black Light

Use a black light having a 365 nanometer intensity of 4,000 microwatts per square centimeter minimum at 15 inches. The Spectroline BIB-150P from Spectronics Corporation satisfies this requirement.

#### 3.12 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

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TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia. - Epoxy Primer Coat <a href="#">MIL-DTL-24441/20</a> Formula 150 Type III (Green)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	51.4	55.4	24.1	28.1	---	---
Volatiles, percent	25.1	29.1	22.6	26.6	---	---
Non-volatiles vehicle, percent	17.5	21.5	47.3	51.3	---	---
Course particles, percent	---	.03	---	.03	---	---
Consistency, grams	350	500	165	250	---	---
Weight						
Kilograms / liter	1.38	1.43	1.23	1.28	---	---
Pounds / gallon	11.5	11.9	10.3	10.7	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	6
Fineness of grind, Hegman	---	---	2	---	---	---
Flashpoint						
Degrees C	35.6	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	14	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	5	---
Sag resistance						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia. - Epoxy Primer Coat <a href="#">MIL-DTL-24441/20</a> Formula 150 Type III (Green)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Micrometers	---	---	---	---	225	---
Mils	---	---	---	---	9	---
Color of dry film to approximate color of <a href="#">SAE AMS-STD-595A</a> color 24272	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Where "Conform" is indicated, refer to specific requirements of <a href="#">MIL-DTL-24441/20</a> .						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
<u>Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/22 Formula 152 Type III (White (Tinted))</u>						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Pigment content, percent	50.3	54.3	24.8	28.8	---	---
Volatiles, percent	25.9	29.9	19.6	23.6	---	---
Non-volatiles vehicle, percent	17.8	21.8	49.6	53.6	---	---
Course particles, percent	---	0.2	---	0.2	---	---
Consistency, grams	165	220	115	185	---	---
Weight						
Kilograms / liter	1.45	1.50	1.21	1.26	---	---
Pounds / gallon	12.1	12.5	10.1	10.5	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	5	---
Sag resistance						
Micrometers	---	---	---	---	300	---

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
<u>Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/22 Formula 152 Type III (White (Tinted))</u>						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Mils	---	---	---	---	12	---
Color of dry film to approximate color of SAE AMS-STD-595A color 27778	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.96	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/22.						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic. - Epoxy Topcoat MIL-DTL-24441/22 Formula 152 Type III (White)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	50.3	54.3	24.8	28.8	---	---
Volatiles, percent	25.9	29.9	19.6	23.6	---	---
Non-volatiles vehicle, percent	17.8	21.8	49.6	53.6	---	---
Course particles, percent	---	0.2	---	0.2	---	---
Consistency, grams	165	220	115	185	---	---
Weight						
Kilograms / liter	1.45	1.50	1.21	1.26	---	---
Pounds / gallon	12.1	12.5	10.1	10.5	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	5	---
Sag resistance						
Micrometers	---	---	---	---	300	---



TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic. - Epoxy Topcoat MIL-DTL-24441/22 Formula 152 Type III (White)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Mils	---	---	---	---	12	---
Color of dry film to approximate color of SAE AMS-STD-595A color 27778	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.96	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/22.						

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TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia. - Epoxy Primer Coat <a href="#">MIL-DTL-24441/29</a> Formula 150 Type IV (Green)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	45.0	50.0	35.0	40.0	---	---
Volatiles, percent	29.0	35.0	15.0	20.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	43.0	48.0	---	---
Course particles, percent	---	.03	---	.03	---	---
Consistency, grams	300	410	470	600	---	---
Weight						
Kilograms / liter	1.33	1.39	1.33	1.39	---	---
Pounds / gallon	11.1	11.6	11.1	11.6	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	6
Fineness of grind, Hegman	3	---	2	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	18	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia. - Epoxy Primer Coat <a href="#">MIL-DTL-24441/29</a> Formula 150 Type IV (Green)						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of <a href="#">SAE AMS-STD-595A</a> color 24272	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Test methods as specified in <a href="#">MIL-DTL-24441</a> . Where "Conform" is indicated, refer to specific requirements of <a href="#">MIL-DTL-24441/29</a> .						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
<u>Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))</u>						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	44.0	49.0	---	---
Course particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms / liter	1.39	1.45	1.29	1.35	---	---
Pounds / gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
<u>Table Ib. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White (Tinted))</u>						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Mils	---	---	---	---	12	---
Color of dry film to approximate color of SAE AMS-STD-595A color 27778	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Test methods as specified in MIL-DTL-24441. Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
<u>Table Ic. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White)</u>						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	44.0	49.0	---	---
Course particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms / liter	1.39	1.45	1.29	1.35	---	---
Pounds / gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic. - Epoxy Intermediate Coat MIL-DTL-24441/31 Formula 152 Type IV (White)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Mils	---	---	---	---	12	---
Color of dry film to approximate color of SAE AMS-STD-595A color 27778	---	---	---	---	---	Conform
Contrast ratio at 75 micrometers, 3 mils DFT	---	---	---	---	0.98	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
GENERAL NOTES: Test methods as specified in MIL-DTL-24441. Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441/31.						

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## SECTION 09 97 13.17

THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS  
05/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN PETROLEUM INSTITUTE (API)

- API Std 650 (2013; Errata 1 2013; Addendum 1 2014; Errata 2 2014; Addendum 2 2016; Addendum 3 2018) Welded Tanks for Oil Storage
- API Std 653 (2014; Addendum 1 2018) Tank Inspection, Repair, Alteration, and Reconstruction

## ASTM INTERNATIONAL (ASTM)

- ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants
- ASTM D3276 (2015; E 2016) Standard Guide for Painting Inspectors (Metal Substrates)
- ASTM D3335 (1985a; R 2020) Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy
- ASTM D3718 (1985a; R 2015) Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy
- ASTM D3925 (2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
- ASTM D4285 (1983; R 2018) Indicating Oil or Water in Compressed Air
- ASTM D4417 (2021) Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
- ASTM D4940 (2015) Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 8502-3 (2017) Preparation of Steel Substrates Before Application of Paints and Related

Products - Tests for the Assessment of Surface Cleanliness - Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method)

ISO 9001

(2015) Quality Management Systems- Requirements

NACE INTERNATIONAL (NACE)

NACE SP0178

(2007) Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service

NACE SP0188

(1999; R 2006) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 1

(2015; E 2017) Mineral and Slag Abrasives

SSPC AB 2

(2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive

SSPC AB 3

(2003; E 2004) Ferrous Metallic Abrasive

SSPC Guide 12

(1998; E 2004) Guide for Illumination of Industrial Painting Projects

SSPC PA 1

(2016) Shop, Field, and Maintenance Coating of Metals

SSPC PA 2

(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements

SSPC PA Guide 11

(2020) Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating

SSPC QP 1

(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)

SSPC QP 2

(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Removal of Hazardous Coatings from Structures)

SSPC QP 5

(2012) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies

SSPC QS 1

(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System

SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC SP 11	(2020) Surface Preparation Standard No. 11 - Power Tool Cleaning to Bare Metal
SSPC SP COM	(2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC-SP WJ-1/NACE WJ-1	(2012) Clean to Bare Substrate, Waterjet Cleaning of Metals
SSPC-SP WJ-2/NACE WJ-2	(2012) Very Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-3/NACE WJ-3	(2012) Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-4/NACE WJ-4	(2012) Light Cleaning, Waterjet Cleaning of Metals

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement
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U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/29	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type IV
MIL-DTL-24441/31	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type IV

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1926.59	Hazard Communication

## 1.2 DEFINITIONS

Definitions are generally provided throughout this Section in the paragraphs where used and denoted by capital letters. The following

definitions are used throughout this Section:

- a. ROOF - Interior tank surfaces that extend from the horizontal plane at the designated maximum fuel line upward, including the upper portion of the tank shell (walls), columns, structural steel, the underside of the roof plates, and other steel components in this area.
- b. SHELL - Interior tank surfaces that extend along the vertical tank walls between the horizontal planes approximately 40 inches above the shell-to-bottom joint upward to the horizontal plane at the designated fuel line, including columns, wall plates, and other steel components in this area.
- c. BOTTOM - Interior tank surfaces below the horizontal plane approximately 40 inches above the shell-to-bottom joint, including columns, wall plates, piping, pipe supports, bottom plates, and other steel components in this area.
- d. INDEPENDENT THIRD-PARTY - Impartial third-party not a part or affiliated with Contractor or subcontractor principal or subsidiary businesses, and not a materials supplier.
- e. STRIPE COAT - An additional corrosion protection measure on edges, outside corners, crevices, bolt heads, welds, and other irregular surfaces, including minor surface preparation on sharp edges.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Corrective Action Request (CAR) Form

Coatings Work Plan

Inspection Report Form

#### SD-05, Design Data

Environmental Control System

Use of Door Sheet Access Way; G[, [\_\_\_\_]]

#### SD-06 Test Reports

Coatings Qualification Test Reports

Joint Sealant Qualification Test Reports

Non-Metallic Abrasive Qualification Test Reports; G[, [\_\_\_\_\_]]

Ferrous Metallic Abrasive Qualification Test Reports

Coating Field Test Reports

Abrasive Field Test Reports

Recycled Ferrous Metallic Abrasive Field Test Reports (Daily and Weekly)

Daily Inspection Reports

#### SD-07 Certificates

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coatings Inspection Company

Qualifications of Quality Assurance Coatings Inspector

Qualifications of Coatings Contractors

Qualifications of Individuals Performing Abrasive Blasting

Qualifications of Individuals Applying Coatings

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Coating Materials Certificate of Conformance

Joint Sealant Materials Certificate of Conformance

Joint Sealant Compatibility

Non-Metallic Abrasive Certificate of Conformance

Ferrous Metallic Abrasive Certificate of Conformance

#### SD-08 Manufacturer's Instructions

Joint Sealant Instructions

Coating System Instructions

#### SD-11 Closeout Submittals

Disposal of Used Abrasive; G[, [\_\_\_\_\_]]

Inspection Logbook; G[, [\_\_\_\_\_]]

Corrective Action Log; G[, [\_\_\_\_\_]]

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies must be addressed and resolved, and the Coatings Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered must be identified at the earliest discoverable time and submitted for resolution. Schedule time (float) must be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

#### 1.4.2 Corrective Action (CA)

CA must be included in the Contractor Quality Control Plan as outlined in Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL.

##### 1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated.

##### 1.4.2.2 Corrective Action Request (CAR) Form

Develop Corrective Action Request (CAR) forms for initiating CA and for tracking and documenting each step. The CAR should be included with the Corrective Action Procedures. A CAR must be initiated by either the Contractor or the Contracting Officer. The Protective Coatings Specialist (PCS) must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

##### 1.4.2.3 Corrective Action Log

When a CAR is initiated, the Contractor must take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These actions must apply to non-compliance in the work, and to non-compliance in the Quality Control (QC) System. Corrective actions must be appropriate to the effects of the non-compliance encountered. The corrective action must be documented in a report that is serialized and tracked in the Corrective Action Log until project completion and acceptance by the Contracting Officer. All corrective action reports must be retained in project records. The Corrective Action Log, showing status of each CAR, must be submitted to the Contracting Officer monthly.

#### 1.4.3 Coatings Work Plan

The Coatings Work Plan must be considered as part of the Contractor Quality Control Plan as outlined in Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL.

The Coatings Work Plan must be submitted and approved by the PCS prior to mobilization. The Coatings Work Plan must explain in detail all procedures including, but not limited to, all sequential processes, quality control for each process, quality assurance for each process, and safety

considerations. Subsections must include at least the following:

- a. Purpose;
- b. Introduction[ (including the [scope of work \(SOW\) project program](#))];
- c. Safety, fire, and health information;
- d. Contractor and worker qualifications with certifications;
- e. Project management organization and documents;
- f. Timeline in a Gantt chart;
- g. Project document references;
- h. Reference to all applicable standards (e.g., AMPP, NACE, SSPC, ISO, and ASTM);
- i. Coatings manufacturer's supporting documentation;
- j. Descriptions and explanations of any exceptions from the coating manufacturer;
- k. Coating and blasting equipment, model names, and, if applicable, calibration dates;
- l. Containment design and details;
- m. Environmental testing;
- n. Material delivery, storage, and handling details;
- o. Surface preparation[ (include procedures for if the pre-existing anchor profile is greater than [4 mils](#) as specified in paragraph [ABRASIVE BLASTING](#))];
- p. Pre-application test panel validation for field-applied external coating as outlined in [SURFACE STANDARD](#);
- q. Coating materials, mixing, application, recoat windows, and coating curing times, if applicable;
- r. Coating repairs and rework;
- s. Non-conformance;
- t. Spent material handling and effluent discharge containment and disposal;
- u. Inspection test plan (as outlined in [FIELD INSPECTION](#), and including inspection hold points, both Quality Assurance and Coating Contractor QC Coatings Inspector's responsibilities, and daily documentation and delivery);
- v. Instruments and test kits;
- w. Soluble salt testing (include procedures that must be used if greater-than-zero soluble salt levels are not able to be removed from the steel surface);

- x. Warranty (in writing, signed by the Contractor and the coating manufacturer's representative);
- y. Demobilization;
- z. PCS and PM approval;

#### 1.4.4 Design Data

##### 1.4.4.1 Environmental Control System

Submit design details of the proposed environmental control system to include ventilation, humidity control, and temperature regulation. Provide calculations for humidity control during separate surface preparation and coating application procedures, ventilation requirements during coating application, and maximum allowable coating application rates to coincide with ventilation. Include basis of design data on local conditions. Provide equipment layout sketches and procedures showing function of each piece of equipment and fail-safe measures. A Certified Industrial Hygienist must approve calculations, work procedures, and personal protective equipment.

##### 1.4.4.2 Use of Door Sheet Access Way

If use of a door sheet access way is desired, submit design drawings and calculations that address all aspects of the door sheet opening in accordance with [API Std 653](#) and [API Std 650](#), including cutting of door sheet, tank stabilization, door sheet replacement, weld testing, and final acceptance. A registered engineer must approve all calculations and procedures prior to submittal for government approval.

#### 1.4.5 Test Reports

##### 1.4.5.1 Coatings Qualification Test Reports

Submit qualification test results from an INDEPENDENT THIRD-PARTY laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be independent laboratories. Samples must have been tested within the last three years.

The purpose of qualification testing is to pre-qualify the coating materials to [MIL-DTL-24441](#). Submit test results for materials in conformance to the requirements of [MIL-DTL-24441](#). Note that this is the same testing that is required for listing on the Qualified Products List (QPL). The coating materials must remain on the QPL for the entire project.

##### 1.4.5.2 Joint Sealant Qualification Test Reports

Submit qualification test results from an INDEPENDENT THIRD-PARTY laboratory of representative samples of joint sealant material that will be used on this project. Samples must have been tested within the last three years. Submit results of conformance to [ASTM C920](#).

##### 1.4.5.3 Ferrous Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of [SSPC AB 3](#). Submit test results from an INDEPENDENT THIRD-PARTY laboratory of representative samples of each abrasive to be used on the jobsite.



Samples must have been tested within the last three years. Note that this testing is for the purpose of pre-qualifying the abrasive.

#### 1.4.5.4 Non-Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of **SSPC AB 1**. Submit test results from an INDEPENDENT THIRD-PARTY laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of pre-qualifying the abrasive.

#### 1.4.5.5 Recycled Ferrous Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from an INDEPENDENT THIRD-PARTY laboratory of daily and weekly Quality Control testing required by **SSPC AB 2**, as modified in paragraph ABRASIVE.

#### 1.4.6 Qualifications

##### 1.4.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY CIH. Submit documentation that the hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. The CIH must remain certified during the entire project, and the Contracting Officer must be notified of any change in certification status within 10 days of the change. If a CIH's certification expires, the hygienist will not be allowed to perform any hygienist functions, and all hygienist work must stop, until the certification is reissued or another CIH is approved. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.4.6.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY PCS. Submit documentation that specialist is certified by the Association for Materials Protection and Performance (AMPP) (formerly SSPC: The Society for Protective Coatings (SSPC)) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coatings inspection company to which the Quality Assurance Coatings Inspector is employed, this does not violate the INDEPENDENT THIRD-PARTY requirements. The PCS must remain certified during the entire project, and the Contracting Officer shall be notified of any change in certification status within 10 days of the change. If a PCS's certification expires, the PCS will not be allowed to perform any PCS functions, and all coatings work must stop, until the certification is reissued or another PCS is approved. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. The PCS must not be the designated Quality Assurance Coatings Inspector. The PCS's responsibilities are outlined in PROTECTIVE COATINGS SPECIALIST (PCS).

##### 1.4.6.3 Qualifications of Coatings Inspection Company

Submit documentation that the coatings inspection company that will be performing all quality assurance coatings inspection functions is certified by AMPP to the requirements of **SSPC QP 5** prior to contract award. The coatings inspection company that is submitted and approved, must remain and cannot be changed through completion of the contract. The coatings inspection company must remain **SSPC QP 5** certified for the duration of the coating work and the Contracting Officer must be notified of any change in certification status within 10 days of the change. If a coatings inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of all scheduled and unannounced on-site audits from AMPP and furnish a copy of all audit reports. The coatings inspection company must not engage in any activities that may conflict with their independence of judgment and integrity in relation to their inspection activities. In particular, they must not be engaged in the manufacture, supply, application, surface preparation, purchase, or maintenance of the applied coating in this project.

#### 1.4.6.4 Qualifications of Quality Assurance Coatings Inspector

Submit documentation that each Quality Assurance Coatings Inspector is employed by the **SSPC QP 5** company and is qualified to a minimum certification of NACE CIP Level II. Each inspector must remain employed by the coatings inspection company while performing any coatings inspection functions. The Quality Assurance Coatings Inspector's responsibilities are outlined in QUALITY ASSURANCE COATINGS INSPECTOR'S FIELD RESPONSIBILITIES. The roles of the Quality Assurance Coatings Inspector are in addition to, and distinct from, the role of the QC Coatings Inspector employed by the coatings Contractor.

#### 1.4.6.5 Qualifications of Coatings Contractors

All Contractors and Subcontractors that perform surface preparation or coating application must be certified to both **SSPC QP 1** and **SSPC QS 1** prior to contract award, and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site audits from AMPP and furnish a copy of all audit reports.

For projects located outside the United States, Guam, and Puerto Rico, the certifications for the coatings Contractor (**SSPC QP 1** and **SSPC QS 1**) can be substituted if the coatings Contractor meets all of the below requirements:

- a. **ISO 9001** certified;
- b. Eight years of experience with industrial coatings;
- c. Evidence of recent work that has Contractor Performance Assessment Report System (CPARS) ratings, and other quality/performance ratings,

that are equivalent to, or exceed, "Above Average";

- d. Evidence of an INDEPENDENT THIRD-PARTY audit from AMPP demonstrating equivalency to **SSPC QP 1** and **SSPC QS 1** within the last two years.
  - [ e. Evidence of an INDEPENDENT THIRD-PARTY audit from AMPP demonstrating equivalency to **SSPC QP 2** within the last two years.
- ] The coatings Contractors and coatings Subcontractors must be certified to **ISO 9001** prior to contract award and must remain so certified for the duration of the project. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site inspections from the ISO certifying organization and furnish a copy of all inspection reports.

#### 1.4.6.6 Qualifications of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by AMPP to the SSPC C7 Abrasive Blaster Qualification Program or CAS Coating Application Specialist Level 2 Certification Program (Interim Status). Each blaster must remain qualified during the entire period of abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status within 10 days of the change. If a blaster's qualification expires, the blaster will not be allowed to perform any blasting functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply.

#### 1.4.6.7 Qualifications of Individuals Applying Coatings

Submit name, address, and telephone number of each person that will be applying coatings. Submit documentation that each applicator is qualified by AMPP to the SSPC CAS Coating Application Specialist Level 2 Certification Program (Interim Status) or SSPC C12 Spray Application Certification. Each applicator must remain certified during the entire period of coating application, and the Contracting Officer must be notified of any change in qualification status within 10 days of the change. If an applicator's qualification expires, the applicator will not be allowed to perform any coatings application functions until the qualification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive qualification will not be considered and liquidated damages will apply.

#### 1.4.6.8 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY laboratory or laboratories selected to perform testing of coating samples for qualification testing and for field sample testing for compliance with this Section. Submit documentation that the laboratory is regularly engaged in testing of paint samples for conformance with specifications and that the employees performing testing are qualified.

#### 1.4.6.9 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, fax number, and e-mail address of the INDEPENDENT THIRD-PARTY laboratory or laboratories selected to perform testing of abrasive for compliance with this Section. Submit documentation that the laboratory has experience in testing samples of abrasive for conformance with specifications and that the employees performing testing are qualified.

#### 1.4.6.10 Coating Materials Certificate of Conformance

Provide manufacturer's certification of conformance to MIL-DTL-24441.

#### 1.4.6.11 Joint Sealant Materials Certificate of Conformance

Provide manufacturer's certification of conformance to ASTM C920 and as modified in this Section.

#### 1.4.6.12 Joint Sealant Compatibility

Provide manufacturer's certification that the selected joint sealant is compatible with the epoxy topcoat.

#### 1.4.6.13 Ferrous Metallic Abrasive Certificate of Conformance

Provide manufacturer's certification of conformance that the materials are currently in conformance with SSPC AB 3 and as modified in this Section, and have been tested within the last three years.

#### 1.4.6.14 Non-Metallic Abrasive Certificate of Conformance

Provide manufacturer's certification of conformance that the materials are currently in conformance with SSPC AB 1 and as modified in this Section, and have been tested within the last three years.

#### 1.4.7 QA and QC Personnel

##### 1.4.7.1 QC Manager

The QC Manager is as defined in Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL.

##### 1.4.7.2 Protective Coatings Specialist (PCS)

The PCS must be considered a QC Specialist and must report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL. The PCS must approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

The PCS's responsibilities include, but are not limited to, the following:

- a. Obtain, review, and understand all project documentation including, but not limited to, this Section, scope of work (SOW) project program, Coatings Work Plan, inspection and testing plan (ITP), and all submittals before the project starts, during the project, and all coatings related re-work;
- b. Attend all pre-job coatings meetings (in-person, phone, or virtually);

- c. Attend pre-final coatings walk-through (mandatory) and attend final coatings walk-through (as required).

#### 1.4.7.3 Quality Assurance Coatings Inspector

The Quality Assurance Coatings Inspector must be considered a QC Specialist and must report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL. The Quality Assurance Coatings Inspector must be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities. The Quality Assurance Coatings Inspector must provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting requirements specified in Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL. The responsibilities of the Quality Assurance Coatings Inspector are defined in QUALITY ASSURANCE COATING INSPECTOR'S FIELD RESPONSIBILITIES. These responsibilities are separate and distinct from the responsibilities of the Coatings Contractor QC Coatings Inspector.

#### 1.4.7.4 Coatings Contractor QC Coatings Inspector

The Coatings Contractor QC Coatings Inspector must stop non-compliant work. The responsibilities of the Coatings Contractor QC Coatings Inspector are defined in COATINGS CONTRACTOR QC COATINGS INSPECTOR'S FIELD RESPONSIBILITIES. These responsibilities are separate and distinct from the responsibilities of the Quality Assurance Coatings Inspector.

#### 1.4.8 Pre-Application Meeting

After approval of submittals, but prior to the initiation of coatings work, Contractor representatives, including at a minimum, project superintendent, QC manager, paint foreman, Quality Assurance Coatings Inspector, and PCS, must have a pre-application coating preparatory meeting. This meeting must be in addition to the pre-construction conference. Specific items addressed must include: corrective action requirements and procedures, coatings work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, and test logs. Notify Contracting Officer at least ten days prior to meeting.

### 1.5 PRODUCT DATA

#### 1.5.1 Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

#### 1.5.2 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

## 1.6 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with [SSPC PA 1](#), and as modified in this Section. Maintain temperature in storage spaces between [40 and 75 degrees F](#), and air temperature more than [5 degrees F](#) above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer.

If materials are approaching shelf life expiration and an extension is desired, samples must be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer must issue an extension, referencing the product evaluation and the review of storage records. Products must not be extended longer than allowed in the product specification.

## 1.7 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions must be followed throughout mixing, application, and curing of the coatings. During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in [29 CFR 1910.1000](#). Comply with respiratory protection requirements in [29 CFR 1910.134](#). The CIH must approve work procedures and personal protective equipment.

## 1.8 WORK SEQUENCE

[Coat tank interior following tank tightness testing.] [Coat tank interior before installation of floating pan.]

## 1.9 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of [API Std 653](#), [ASTM C920](#), [ASTM D3276](#), [ASTM D3925](#), [ASTM D4285](#), [ASTM D4417](#), [ASTM D4940](#), [NACE SP0178](#) and companion visual comparator, [NACE SP0188](#), [SSPC AB 1](#), [SSPC AB 2](#), [SSPC AB 3](#), [SSPC SP COM](#), [SSPC SP 1](#), [SSPC SP 10/NACE No. 2](#), [SSPC SP 11](#), [SSPC PA 1](#), [SSPC PA 2](#), [SSPC Guide 12](#), [SSPC VIS 1](#), [SSPC QP 1](#), [[SSPC QP 2](#), ][SSPC QS 1](#), and an SSPC Certified Contractor Evaluation Form at the job site.

## PART 2 PRODUCTS

### 2.1 COATING SYSTEM

Coating systems must be as specified herein; alternate systems will not be considered. All primer, intermediate, and topcoat materials must be manufactured by one manufacturer and supplied by one supplier. [ The entire coating system is intended to be applied in the field. Alternatively, surface preparation may be accomplished in the shop, following all temperature, humidity, and testing requirements listed herein, followed by an application of a hold-primer. Upon completion of field fabrication, all shop-applied coatings must be removed, surfaces prepared to [SSPC SP 10/NACE No. 2](#), and the specified coating system applied. Adjust

all shop preparation to avoid conflicts with final surface preparation requirements.]

#### 2.1.1 Epoxy Primer, Intermediate, and Topcoats

The epoxy coating materials must be approved by the Naval Sea Systems Command and listed on their current Qualified Products List (QPL) for the specified materials.

##### 2.1.1.1 Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/29 (Formula 150, Type IV, Green).

##### 2.1.1.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

##### 2.1.1.3 Epoxy Topcoat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White).

#### 2.2 JOINT SEALANT

Industrial grade, two component, minimum 95 percent solids by volume, polysulfide type caulking material that has a minimum history of 10 years acceptable service in fuel tanks. Sealant must be compatible with the coating and suitable for direct application to prepared steel surfaces. Sealant must contain no more than 0.06 percent by dry weight lead, no more than 0.06 percent by dry weight cadmium, and no chromium. Joint sealant must be qualified to ASTM C920, Type M, Grade NS or P.

#### 2.3 COATING FIELD COLLECTION KIT

Provide a kit for each sample to be collected. Each kit must contain: a one quart can for the base of the coating material; one appropriately sized can for the activator of the coating material; dipping cups for each component to be sampled; a shipping box sized for the samples to be shipped; and packing materials. Mark cans for the appropriate coating material and component (base or activator), including manufacturer's name, address, batch numbers, batch size shipped to the project site, and date of manufacture. Provide shipping documents, including either pre-paid shipping labels or a shipping number that can be used by the QC Manager to arrange pickup, addressed to the INDEPENDENT THIRD-PARTY coating testing laboratory.

#### 2.4 ABRASIVE FIELD COLLECTION KIT

Provide a kit for each sample to be collected. Each kit must contain one suitable plastic bag or container for each sample to be collected. Mark containers with manufacturer's name, address, batch number, batch size, and date of manufacture. Provide shipping documents, including either pre-paid shipping labels or a shipping number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

#### 2.5 INSPECTION TEST KITS

### 2.5.1 Test Kit for Measuring Chloride, Sulfate, and Nitrate Ions on Steel and Coated Surfaces

Provide test kits that meet all of the following requirements:

- a. Contains all materials, supplies, tools, and instructions for field testing and on-site quantitative evaluation of chloride, sulfate, and nitrate ions;
- b. Extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;
- c. Components and solutions are mercury free and environmentally friendly;
- d. Contains new materials and solutions for each test extraction;
- e. Contains an extraction test container (vessel, sleeve, cell) creates a sealed, encapsulated environment during salt ion extraction;
- f. Contains a test extract container is suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;
- g. All salt ion concentrations are directly measured in micrograms per square centimeter.

### 2.5.2 Test Kit for Measuring Chlorides in Abrasives

Provide test kits that meet all of the following requirements:

- a. Is a completely self-contained test kit with all materials, supplies, tools, and instructions to take tests and identify results;
- b. Uses identifiable, consistent, factory pre-measured test extract solution;
- c. Provides for testing equal volumes of abrasive and test solution;
- d. Provides for taking direct measurements of the chloride ion in parts per million (PPM), without using conversion charts or tables;
- e. Provides all new components for extraction and titration for each test;
- f. Provides a factory sealed titration device for each test;
- g. Uses the extract sampling container as the titration container.

### 2.5.3 Test Kit for Identifying Amine Blush on Epoxy Surfaces

Provide test kits that meet all of the following requirements:

- a. Is a completely self-contained field test kit with all materials, supplies, tools, and instructions to perform tests and indicate the presence of unreacted amines;
- b. Uses an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;



- c. Contains no mercury or lead and is environmentally friendly;
- d. Contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution;

## 2.6 ABRASIVE

Use abrasive that is specifically selected to provide a sharp, angular profile to the specified depth. Abrasive must meet all requirements of this Section each time that it is placed in the blast pot. A maximum limit for soluble salt contamination (chloride) is specified herein; however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors, such as on-site handling and recycling, can allow contamination of abrasive that can be transferred to the steel surface. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of contamination in abrasive does not negate the final acceptance testing of steel surfaces.

[ Abrasive material used must contain a maximum of one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 of [29 CFR 1910-SUBPART Z](#), with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

]

[ Gross gamma radioactivity must not exceed 5 picocuries per gram.

### ]2.6.1 Ferrous Metallic Abrasive

#### 2.6.1.1 New and Remanufactured Steel Grit

New and remanufactured steel grit abrasive must conform to the chemical and physical properties of [SSPC AB 3](#) Class 1 (Steel) only; Class 2 (Iron) abrasive must not be used. Modify the requirements of [SSPC AB 3](#) to substitute the requirement in paragraph 4.2.2 CONDUCTIVITY for one chloride test as measured using the test kit described in this Section (paragraph TEST KIT FOR MEASURING CHLORIDES IN ABRASIVES). The maximum allowable chloride content is 25 parts per million (PPM).

To develop a suitable work mix from new steel abrasive, a minimum of 200 to 400 recycles is required; therefore, it may be advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project. Such grit must be traced to new grit conforming to [SSPC AB 3](#) Class 1 and it meets all cleanliness requirements of [SSPC AB 3](#) Class 1 when brought to the current jobsite. Submit one representative sample of this work mix to the INDEPENDENT THIRD-PARTY laboratory for testing, along with samples of new material. Acceptance and use of this work mix must not be used to justify any deviation from surface preparation requirements.

#### 2.6.1.2 Recycled Steel Grit

Recycled steel grit abrasive media must conform to the chemical and physical properties of [SSPC AB 2](#) except that:

- a. The maximum allowable chromium and cadmium content of the work mix must be 0.1 percent by weight when tested in accordance with [ASTM D3718](#)

for chromium and [ASTM D3335](#) for cadmium. Modify the requirements of [SSPC AB 2](#) to add requirement for one chromate test and one cadmium test for each "LEAD" test required.

b. The maximum allowable chloride content is 25 parts per million (PPM) as measured with the test kit described in paragraph TEST KIT FOR MEASURING CHLORIDES IN ABRASIVES. Modify the requirements of [SSPC AB 2](#) to substitute requirement for one chloride test for each "WATER SOLUBLE CONTAMINANTS" test.

#### 2.6.2 Non-Metallic Abrasive

Non-metallic abrasive must be graded to the appropriate surface profile range and must conform to the chemical and physical properties of [SSPC AB 1](#), Class A except that:

- a. The maximum allowable chromium and cadmium content of the work mix must be less than 0.1 percent by weight when tested in accordance with [ASTM D3718](#) for chromium and [ASTM D3335](#) for cadmium.
- b. Must contain less than 7 PPM chlorides when tested with the kit provided in paragraph TEST KIT FOR MEASURING CHLORIDES IN ABRASIVES.

### PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coatings Work Plan. The Coatings Work Plan must be submitted and approved by the PCS prior to mobilization, in accordance with the paragraph COATINGS WORK PLAN.

#### [3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, must be handled in accordance with Section [02 83 00 LEAD REMEDIATION](#). Coordinate surface preparation requirements from Section [02 83 00 LEAD REMEDIATION](#) with this Section.

#### ] [3.2 DOOR SHEET ACCESS WAY

A door sheet may be cut out of a tank to facilitate personnel and equipment access. The door sheet must be removed in accordance with [API Std 653](#) and [API Std 650](#), including all structural, welding, testing, and evaluation requirements. The door sheet must be installed, tested, and accepted prior to commencement of surface preparation. The door sheet and surrounding areas must be surfaced in accordance with Section 4 of [NACE SP0178](#), and accompanying Visual Comparator, to the condition described and shown for NACE Weld Surface Preparation Designation "C" welds for interior surfaces and "D" Welds for exterior surfaces. The Contractor is responsible for cutting out the door sheet, stabilizing the tank or openings while the door sheet is out, replacing the door sheet, and testing the replaced door sheet using qualified engineering and testing services. Perform tank tightness testing before surface preparation where a door sheet access way was installed for this project. Hydrostatic testing must be performed prior to commencement of surface preparation.

#### ] 3.3 FIELD SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite as required in TEST

REPORTS and subsequent subparagraphs. Notify the Contracting Officer three days in advance of sampling. The QC Manager, and either the PCS or Quality Assurance Coatings Inspector, shall witness all sampling.

### 3.3.1 Coating Field Sample Collection

Coatings that are on the MIL-DTL-24441 QPL require one sample to be collected. This sample must be collected and set aside for the duration of the project, and must be tested if unforeseen coatings issues arise or if testing is requested by the Contracting Officer. Coatings that are not on the MIL-DTL-24441 QPL require a random field sample from each lot of coating material used on-site in accordance with ASTM D3925. Each random sample must be tested.

For sampling, utilize sample collection kits as outlined in the paragraph COATING FIELD SAMPLE COLLECTION KIT. Each sample must consist of one quart sample of each batch of each base material, and a sample of the activator that is proportional to the mix ratio of the coating type. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to the INDEPENDENT THIRD-PARTY laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. If testing is required, the QC Manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and ship one complete sample of each material in question (including base and activator) with all batch information to the INDEPENDENT THIRD-PARTY laboratory for testing as required in paragraph COATING FIELD TESTING REPORTS.

### 3.3.2 Abrasive Field Sample Collection

Utilize the sample collection kits as required in paragraph ABRASIVE FIELD SAMPLE COLLECTION KIT to obtain samples from each lot of abrasive delivered to site using the sampling techniques and schedule of one sample per every 50 bags for ferrous metallic abrasive, paragraph 4 REQUIREMENTS FOR RECYCLED WORK MIX ABRASIVES of SSPC AB 2 for recycled ferrous metallic abrasives, or paragraph 5.3 SAMPLING FOR QUALITY CONTROL TESTS of SSPC AB 1 for non-metallic abrasives.

For purposes of quality conformance inspection, a lot must consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. The addition of any substance to a batch must constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing required in paragraph ABRASIVE FIELD SAMPLE TEST REPORTS.

### 3.3.3 Coating Field Test Reports

Submit test results for each sample that requires testing in paragraph COATING FIELD SAMPLE COLLECTION. Test samples of primer, intermediate, and

topcoat materials for compliance with requirements of MIL-DTL-24441. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

#### 3.3.4 Abrasive Field Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of ferrous metallic abrasive to the requirements of paragraph 5.2 TEST PARAMETERS of SSPC AB 3, excluding paragraph 5.2.4 DURABILITY. Test samples of recycled ferrous metallic abrasives to the requirements of paragraph 4 REQUIREMENTS FOR RECYCLED WORK MIX ABRASIVES of SSPC AB 2. Test samples of non-metallic abrasive to the requirements of paragraph 5.3 SAMPLING FOR QUALITY CONTROL TESTS of SSPC AB 1. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

#### [3.4 FUEL REMOVAL AND TANK CLEANING

Remove fuel and clean storage tanks in accordance with Section 33 01 50.55 CLEANING PETROLEUM STORAGE TANKS.

#### ]3.5 LIGHTING

Provide lighting for all work areas as prescribed in SSPC Guide 12.

#### 3.6 ENVIRONMENTAL CONDITIONS

##### 3.6.1 Tank Containment

Maintain exterior tank containment in full working condition during interior surface preparation, coating application, and initial curing to aid in maintaining interior environmental conditions.

##### 3.6.2 Control System Requirements

Provide and utilize dehumidification and ventilation equipment to control humidity, temperature, and vapor levels in tank from beginning of abrasive blasting through coating application and for four days after the last coating is applied. System must maintain vapor concentrations at or below 10 percent of Lower Explosive Limit (LEL). System may incorporate any combination of solid desiccant and direct expansion refrigeration equipment. No liquid, granular, calcium chloride, or lithium chloride drying systems will be accepted. Use only electric, indirect fired combustion, indirect friction, or steam coil auxiliary heaters. System must be compatible with removal of dust and solvent vapors, and must have fail-safe measures to ensure reliability during operations.

##### 3.6.2.1 Automated Monitoring Requirements

Provide continuous monitoring of dehumidification equipment, temperature, relative humidity, and dew point data at pertinent points on the structure, during surface preparation, coating application, and initial cure. This data does not suffice for documentation of conformity to surface conditions during application and cure of coating. Locate sensors to provide pertinent data for the surface preparation and coat application being performed. Describe the location plan, including required moves, in the Coatings Work Plan. Provide monitoring equipment to perform as follows:

- a. Data is collected in the field unit in 15-minute increments and

available for download (on-site) in a standard database format. Contractor must collect these data and make available to the Contracting Officer, Quality Assurance Coatings Inspector, and QC Manager;

- b. Monitoring equipment must have backup power such that data collection will be uninterrupted during the entire period of the dehumidification requirement;
- c. Monitoring equipment must have capability to measure surface temperatures at a minimum of four locations anywhere on a structure, regardless of the size of the structure;
- d. Monitoring equipment must have capability to measure interior and exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP);

There is no requirement for connectivity of the monitoring system to control the dehumidification equipment; therefore, any combination of equipment having the required functionality will be accepted.

#### 3.6.2.2 Humidity Control for Surface Preparation and Primer Application

Provide and utilize dehumidification equipment to maintain relative humidity at appropriate level to prevent prepared steel surfaces from corroding at all times during abrasive blasting through primer application. Failure of humidity control system, or failure to maintain proper conditions, during surface preparation stage may allow surface rusting, which will be rejected and require rework. All surfaces to be coated must meet all requirements at time of primer application. Failure of humidity control system during primer application stage will be cause for removal and replacement of all materials applied and cured while conditions were not as prescribed above.

#### 3.6.2.3 Humidity Control for Application of Intermediate and Topcoats and Initial Curing

Provide and utilize dehumidification equipment to maintain relative humidity at the coldest steel surface in tank below 55 percent at all times during coating application, and during the first four days of initial curing after application of topcoat. This measurement is not the same as measuring the relative humidity of ambient air in the tank, and will require either electronic equipment to monitor relative humidity at the steel surface, or complex calculations to convert relative humidity of air in tank to relative humidity at steel surface. An approved alternative method of monitoring dehumidification that requires less sophisticated equipment or calculations is to maintain a minimum dew point depression of 18 degrees F below coldest steel surface temperature. This is in lieu of specific relative humidity and dew point requirements in this Section. Failure to maintain specified humidity control during this phase will be cause for extension of humidity controlled cure time to ensure four consecutive days at specified relative humidity at steel surfaces. Formation of condensation in coating application stage prior to the indicated dry-hard time will be cause for removal and replacement of all materials contacted by condensation.

#### 3.7 EQUIPMENT USED IN TANK

Equipment used in the tank after surface preparation begins must not leave

any oily residue from exhaust or other sources. Internal combustion driven equipment, other than that powered by natural or bottled gas, must not be used.

### 3.8 SURFACES TO BE COATED

Prepare and coat interior tank surfaces, including[ BOTTOM][, SHELL][, ROOF][ spot repair of [\_\_\_\_\_] spots of [\_\_\_\_\_] square feet]. Remove interior piping to ensure complete coverage of the bottom and underside of pipe supports.[ Do not coat aluminum floating pan.]

### 3.9 SURFACE PREPARATION

Prepare steel surfaces in accordance with **SSPC PA 1** and as specified herein.

#### 3.9.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of **95 psig** at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with **ASTM D4285**. Test air quality at each startup, but in no case, less often than every five operating hours.

#### 3.9.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required in **SSPC AB 1** for non-metallic abrasives, **SSPC AB 2** for recycled ferrous abrasives, and **SSPC AB 3** for ferrous abrasives. Modify the schedule of testing to be daily, at startup, and every five operating hours thereafter.

#### 3.9.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more **1 foot** square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with **ASTM D4417**, Method C. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

#### 3.9.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

##### 3.9.4.1 Pre-Preparation Testing for Oil and Grease Contamination

- a. Inspect all surfaces for oil or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) BLACK LIGHT TEST, and 4) CLOTH RUB TEST. Reject oil- or grease-contaminated surfaces, clean [using a water based, pH-neutral degreaser ]in accordance with **SSPC SP 1**, and recheck for contamination until surfaces are free of oil and grease.
- b. WATER BREAK TEST - Spray atomized mist of distilled water onto surface and observe for water beading. If water wets surface rather than beading up, surface can be considered free of oil or grease

contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

- c. BLACK LIGHT TEST - Inspect surfaces for oil and grease contamination using the light specified in the paragraph BLACK LIGHT. Use light no more than 15 inches from surface unless testing indicates that the specific oil or grease found in tank fluoresce at a greater distance. Use light in tank that is completely sealed from light infiltration, under a hood, or at night. Any fluorescing on steel surfaces is indication of petroleum oil/grease contamination. Use either WATER BREAK TEST or CLOTH RUB TEST to confirm both contaminated and non-contaminated areas detected by BLACK LIGHT TEST. The BLACK LIGHT TEST must not be used during inspection of prepared surfaces for oil and grease contamination unless proven to fluoresce the oil and grease found in the specific tank and documented during testing prior to abrasive blasting. Generally, only petroleum oil/grease will fluoresce; however, some may not fluoresce sufficiently to be recognized and other methods, such as the WATER BREAK TEST or CLOTH RUB TEST, must be used to confirm findings of the BLACK LIGHT TEST.
- d. CLOTH RUB TEST - Rub a clean, white, lint-free, cotton cloth onto the surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent must be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

#### 3.9.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. This phase is required since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. The purpose of soluble salts testing prior to surface preparation is to establish a baseline reading. Test all surfaces at rate of three tests for the first 1000 square feet, plus one test for each additional 2000 square feet, or part thereof. [Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting.] [Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds.] One or more readings greater than non-detectable for chlorides, sulfates, or nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as described below, allow to dry, and re-test until all required tests show allowable results. Re-blast tested areas using vacuum equipped blast equipment. Label all test tubes and retain for test verification. Soluble salts testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, non-toxic, non-corrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are as stated in the Coatings Work Plan.

### 3.9.5 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with **SSPC SP 10/NACE No. 2**. Prepared surfaces shall conform to **SSPC VIS 1** and shall match the prepared test-panels as specified in paragraph SURFACE STANDARD. Provide a **2 to 4 mil** surface profile. Reject profile greater than **4 mils**, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with **ASTM D4417**, Method A and Method C. The appearance of the surface after blasting must have the appearance of a Sand or Grit comparator. A rounded profile shape or peened surface is not acceptable. Record all measurements required in this standard. Measure profile at rate of three test areas for the first **1000 square feet** plus one test area for each additional **1000 square feet** or part thereof. When surfaces are re-blasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Dust and debris tend to collect at welds, plate overlaps, and surface irregularities. Do not attempt to wipe surface clean.

[ On previously coated and prepared surfaces, determine and establish the average existing surface profile. If the pre-existing surface profile is greater than **4 mils**, or than what is allowable by the coating system instructions, the contractor must acquire written approval by the manufacturer to utilize a higher anchor profile. The manufacturer's supporting letter must state that the additional profile will not degrade coating performance in any way and will be warranted the same. Abrasive blast the steel surfaces to near-white metal in accordance with **SSPC SP 10/NACE No. 2** using abrasive and technique which does not increase the existing profile. Provide a surface profile of at least **4 mils** but no additional profile than that existing. Reject profile greater than existing, discontinue abrasive blasting, and modify processes and materials to provide the specified agreed existing profile. Prepared surfaces must conform to **SSPC VIS 1** and must match the prepared test-panels as specified in paragraph SURFACE STANDARD. Measure surface profile in accordance with **ASTM D4417**, Method A and Method C. The appearance of the surface after blasting must have the appearance of a Sand or Grit comparator. A rounded profile shape or peened surface is not acceptable. Record all measurements required in this standard. Measure profile at rate of three test areas for the first **1000 square feet** plus one test area for each additional **1000 square feet** or part thereof. Provide two additional measurements for each non-compliant measurement. When surfaces are re-blasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Dust and debris tend to collect at welds, plate overlaps, and surface irregularities. Do not attempt to wipe surface clean. On previously coated and prepared surfaces, profiles higher than **4 mils** should be anticipated and these procedures must be included in the Coatings Work Plan.

] [For maintenance coating the use of **SSPC-SP WJ-1/NACE WJ-1**, **SSPC-SP WJ-2/NACE WJ-2**, **SSPC-SP WJ-3/NACE WJ-3**, or **SSPC-SP WJ-4/NACE WJ-4** preparation is acceptable. Potable water must be used. The quality of the water must be monitored. The water quality must be adjusted to assure appropriate surface preparation and final surface requirements. Water must not contain dissolved or suspended material. High chlorides, even in potable water, can leave unacceptable contamination on cleaned surfaces, and must not be suitable for waterjetting.

### ] 3.9.6 Disposal of Used Abrasive



Dispose of used abrasive off Government property in accordance with Federal, State, and Local mandated regulations.

### 3.9.7 Pre-Application Testing for Surface Contamination

#### 3.9.7.1 Pre-Application Testing for Oil and Grease Contamination

Ensure tank surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION.

#### 3.9.7.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for soluble salts contamination using the test kit described in paragraph TEST KIT FOR MEASURING CHLORIDE, SULFATE, AND NITRATE IONS ON STEEL AND COATED SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet; plus one test for each additional 2000 square feet; or part thereof. [ Concentrate testing of bare steel where areas of coating failure to bare steel and areas of corrosion pitting were located.][ Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds.] Label all test tubes and retain for test verification. One or more readings greater than non-detectable for chlorides, sulfates, or nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as required in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION, allow to dry, and re-test until all required tests show acceptable results. Re-blast tested areas using vacuum equipped blast equipment. An atmospheric event, such as a coastal storm blowing onshore, can bring chloride contamination. Following an atmospheric event, spot testing must be accomplished to verify satisfactory conditions and to avoid intercoat contamination. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

#### 3.9.7.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, use ISO 8502-3. Use a kit that is compliant with ISO 8502-3. If the test does not result in a rating of 2 or better, then reject contaminated surfaces, clean by vacuum cleaning, and retest. Test surfaces at rate of three tests for the first 1000 square feet, plus one test for each additional 1000 square feet, or part thereof. Provide two additional tests for each failed test or questionable test. Document test results in the Daily Inspection Report and attach tape to the Daily Inspection Log.

Ferrous abrasives may become magnetized and difficult to remove from the steel substrate. If ferrous abrasives are used, additional visual inspection must be performed to ensure no surface contamination by the abrasive is present.

### 3.10 MIXING AND APPLICATION OF COATING SYSTEM AND SEALANT

#### 3.10.1 Preparation of Sealant and Coating Materials for Application

Each of the different products, primer, intermediate, topcoat, and sealant, is a two-component material supplied in separate containers.

##### 3.10.1.1 Mixing

Mix in accordance with coating system instructions, which may differ for

each product. Do not mix partial kits unless standardized measuring cups are utilized. Do not alter mix ratios. All mixing processes must be witnessed by the Quality Assurance Coatings Inspector. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time based on its temperature.

#### 3.10.1.2 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Do not add solvent to extend pot life. All required solvent at time of mixing. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop, it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. In hot climates, pre-cooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F will extend pot life. The approximate pot life time for the epoxy primer and intermediate coat materials is four hours. The approximate pot life time for the sealant materials is as specified by the manufacturer.

#### 3.10.1.3 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures.

- a. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of primer, STRIPE COAT, intermediate coat, topcoat, and sealant, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.
- b. Maintain air and steel surface temperature within the range allowable by the manufacturer's PDS during application and the first four hours of cure for each epoxy coat. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period. These conditions may require environmental controls through containment.
- c. If coating is not applied during recoat window specified by the coating manufacturer, or if surface temperature exceeds the temperature recommended in the manufacturer's PDS between applications, provide GLOSS REMOVAL. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as non-compliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT. The topcoat must be free of defects and be of uniform appearance in accordance with SSPC PA 1. Lack of hiding by the finish coat must require additional applications to obtain uniform appearance.

- d. FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 2 to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.
- e. GLOSS REMOVAL - Where required, hand sand in a circular fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer or intermediate coats is to scarify surface. If steel is exposed during GLOSS REMOVAL, repair in accordance with PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of the topcoat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

### 3.10.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of each epoxy coat or sealant for amine blush contamination using the test kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet, plus one test for each additional 2000 square feet, or part thereof. If one or more tests show positive results for amine blush contamination, either treat all surfaces using the approved amine blush removal procedure or increase testing to ensure that all contamination is located, and then treat identified contamination using the approved procedure.

### 3.10.3 Application of Coating System and Joint Sealant

Apply coatings in accordance with SSPC PA 1, SSPC PA Guide 11 and as specified herein. Apply coatings and sealant to surfaces that meet all stated surface preparation requirements.

- a. Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate overlaps are no less than 6 inches from welds. Apply STRIPE COAT by brush, working the material into corners, crevices, pitted areas, and welds, and onto outside corners and angles. For convenience, STRIPE COAT material may be delivered by spray if followed immediately with brush-out and approved procedures include appropriate controls on thickness. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond [ 15 ] feet from the tank perimeter [the tank berm]. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of portable shelters or other appropriate controls.
- b. After application of primer coat, and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION to ensure minimal intercoat contamination. If contamination is detected, wash per SSPC SP 1 and re-inspect. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and the quality of air entering tank is controlled. Spot testing must be accomplished to verify

satisfactory conditions and to avoid intercoat contamination. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination or to define extent of contamination for appropriate treatment.

Apply coatings at the following specified thickness and in the following order:

<u>Coat</u>	<u>Minimum DFT (Mils)</u>	<u>Maximum DFT (Mils)</u>
Primer	3	5
Intermediate	3	5
Top	3	5
Total system	9	15

Measure coating thickness in accordance with [SSPC PA 2](#) to confirm that coating application is within the specified range and within the tolerances of that standard. For non-compliant areas, increase number of test areas to identify all non-compliant application as required by [SSPC PA 2](#). Add coating as required to correct low DFT areas, and remove coating with excess thickness to bare steel and reapply as specified in PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING.

#### 3.10.3.1 Application of STRIPE COAT

Apply STRIPE COAT of epoxy primer material prior to application of general primer coat on ROOF and SHELL. Apply STRIPE COAT of epoxy intermediate coat material after application of general primer coat on BOTTOM. A STRIPE COAT must be applied to areas where joint sealant will be applied. This application must be consistent with APPLICATION OF COATING SYSTEM AND JOINT SEALANT. The STRIPE COAT must be in a contrasting color to the preceding and subsequent coats and extend a width of no less than 1.5 inches on each side of the feature being protected.

#### 3.10.3.2 Application of Primer

Apply primer coat within recoat window of STRIPE COAT.

#### 3.10.3.3 Application of Intermediate Coat

Apply intermediate coat within recoat window of primer coat.

#### 3.10.3.4 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING prior to applying topcoat. Apply topcoat within recoat window of intermediate coat. Consult manufacturer for application procedures for anticipated temperature and humidity conditions. Touch-up blemishes and defects within recoat window of epoxy topcoat.

#### 3.10.3.5 Application of Joint Sealant

After a full coating system has been installed, holiday tested, and

repaired as necessary, apply sealant to the roof-to-shell joint, to all roof plate lap joints, and to roof-to-rafter joints up to 1 inch gap to exclude moisture from these marginally prepared crevice areas.

#### 3.10.4 Holiday Testing

When the coating is dry to handle, but before the joint sealant is applied, perform holiday testing in accordance with the low voltage wet sponge method of NACE SP0188. Dry to handle is defined as curing to the degree that the surface will not be marred or damaged by normal foot traffic. Repair holidays per PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING.

#### 3.10.5 Tank Occupancy After Coating Application

Verify the coating has reached a cured state that will allow foot traffic. Use clean canvas, or other approved, shoe covers when walking on coated surfaces, regardless of curing time allowed. Provide cushioned mats for all traffic areas.

#### 3.10.6 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, and before application of the succeeding coat. Any holiday found must have a STRIPE COAT applied in the area prior to application of the finish coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. If spot repair locations are less than 0.5 percent of the surface area and no greater than 6 inches in diameter, prepare surface to SSPC SP 10/NACE No. 2 vacuum blasting or SSPC SP 11 using an impact tool to create an acceptable profile. Do not abrade the epoxy topcoat. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within recoat window of preceding coat. Within four hours of preparation, apply primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system. If one percent or more of the total surface area, or more than one spot per 2000 square feet, of the BOTTOM area requires repair to any coat or coats, including feathered areas, the entire BOTTOM coating system must be removed and reapplied. The limit on BOTTOM repairs includes repairs made before and after floating pan installation. If 5 percent or more of the total surface area, or more than one spot per 1000 square feet, of the ROOF area requires repair to any coat or coats, including feathered areas, the entire ROOF coating system must be removed and reapplied. Repairs on the SHELL are not limited.

#### 3.10.7 Extended Cure of Coating System Prior to Immersion Service

Allow a cure time of at least 14 days after the final coating material has been applied before introducing water or fuel into tank. [Allow a cure time of 12 days after the final coating material has been applied before beginning installation of the floating pan.]

#### 3.11 PROJECT IDENTIFICATION

At the completion of the tank work, stencil the following information on the exterior of the tank adjacent to the main manway opening in 3/4- to one-inch Helvetica style letters of contrasting color using acrylic stencil paint:

Date Interior coated:

Project Number:

Contractor:

Address:

Coating System

Surface Prep: SSPC SP \_\_\_\_\_ Profile: \_\_\_\_\_

Primer: \_\_\_\_\_ Thickness: \_\_\_\_\_

Intermediate: \_\_\_\_\_ Thickness: \_\_\_\_\_

Topcoat: \_\_\_\_\_ Thickness: \_\_\_\_\_

Total Thickness: \_\_\_\_\_

### 3.12 FIELD QUALITY CONTROL

Project documentation, including inspection and testing records, must be used to determine the Contractor's compliance with contract requirements and approved procedures. The Contractor's certifications of completion, for both invoices and for project completion, shall be based on documented evidence of compliance with all requirements and approved Coatings Work Plan procedures. Track inspections and tests in the Test Plan & Log.

#### 3.12.1 Field Inspection

##### 3.12.1.1 Inspection and Documentation Requirements

- a. Perform field inspection in accordance with [ASTM D3276](#) and the approved Coatings Work Plan.
- b. Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:
  - (1) Location or area;
  - (2) Purpose (required or special);
  - (3) Method;
  - (4) Criteria for evaluation;
  - (5) Results;
  - (6) Determination of compliance;
  - (7) List of required rework;
  - (8) Observations.
- c. Collect and record environmental conditions as described in [ASTM D3276](#) on a 24 hour basis, as follows:

- (1) During surface preparation, every hour, or when changes occur;
  - (2) During coating application and the first four days of initial cure, every hour, or when changes occur;
  - (3) Note location, time, and temperature of the highest and lowest surface temperatures each day;
  - (4) Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.
- d. Data collected on environmental conditions in AUTOMATED MONITORING REQUIREMENTS may be used for overnight data; however, the data must be constantly verified as to location of sensors and validity of data with respect to the coating work being accomplished.
- e. Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed. Work documented using data from equipment found to be out of calibration must be considered as non-compliant since last calibration or calibration check, as required.
- f. Document Contractors compliance with the Coatings Work Plan.

#### 3.12.1.2 Inspection Report Form

Develop project-specific report forms, as required, to report measurement and test results and observations being complete and compliant with contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of compliance of each inspected item. Annotation of non-compliance must be conspicuous so as to facilitate identification and transfer to the Rework Log. Report forms must include requirements and acceptance and rejection criteria, and must be legible and presented so that entered data can be quickly compared to the appropriate requirement. The data may be in any format, but must be legible and presented so that entered data can be quickly compared to the appropriate requirement.

#### 3.12.1.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework, in accordance with QC procedures of Section 01 45 00.00 10 01 45 00.00 20 QUALITY CONTROL. Each report must be signed by the Quality Assurance Coatings Inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

#### 3.12.1.4 Inspection Logbook

A continuous record of all activity related to this Section must use an electronic reporting program as outlined in Table I and be maintained on a daily basis. The computer / software package must be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information including photo documentation where appropriate.

In areas where photography is not allowed, the computer must come with verification that the camera / photo capability has been removed. Alternatively, a continuous record of all activity related to this Section must be maintained in an Inspection Logbook on a daily basis. The logbook must be hard or spiral-bound book or digital program with consecutively numbered pages, and must be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. Submit the original Inspection Logbook to the Contracting Officer upon completion of the of the project and prior to final payment.

#### 3.12.1.5 Inspection Equipment

All equipment must be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

##### 3.12.1.5.1 Black Light

Use a black light having a 365-nanometer intensity of 4,000 microwatts per square centimeter minimum at 15 inches.

#### 3.12.2 Coatings Contractor QC Coatings Inspector's Field Responsibilities

The Coatings Contractor QC Coatings Inspector responsibilities include complete documentation of all daily inspection and production activities for the entire coatings project as outlined in the Coatings Work Plan, [scope of work \(SOW\) project program](#), and this Section. This includes, but is not limited to, the following:

- a. Attending and documenting the pre-job meeting and acquiring the [scope of work \(SOW\) project program](#), inspection and testing plan (ITP), schedule, and a list of who will receive the QC daily inspection reports;
- b. Performing a project site walk-through with the Quality Assurance Evaluator (QAE) or asset owner, Coatings Contractor QC, QC Manager, and Quality Assurance Coatings Inspector, inspecting at least the following:
  - (1) Asset(s) to be coated;
  - (2) Equipment and placement of equipment;
  - (3) Materials delivery and storage;
  - (4) Facility operational requirements during the project.
- c. Perform all daily and hold point inspections including, but not limited to, the following:
  - (1) Check equipment, including blotter test to verify compressed air cleanliness;
  - (2) Perform non-visible contaminants testing (in accordance with PRE-PREPARATION TESTING FOR SOLUBLE SALT CONTAMINATION and PRE-APPLICATION TESTING FOR SOLUBLE SALT CONTAMINATION);
  - (3) Perform visible contaminants testing (in accordance with PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION and PRE-APPLICATION TESTING FOR OIL AND GREASE CONTAMINATION);



- (4) Obtain environmental readings;
  - (5) Perform abrasive field testing per [SSPC AB 1](#), [SSPC AB 2](#), or [SSPC AB 3](#);
  - (6) Perform surface preparation monitoring and testing;
  - (7) Perform surface cleanliness testing;
  - (8) Perform dust quantity testing;
  - (9) Record materials storage documentation (record all coating and abrasive materials information, batch numbers, segregation, and storage temperature);
  - (10) Witness all coatings materials mixing and record mix materials temperatures, with verification of time of coatings pot life;
  - (11) Verify, witness, and record application method;
  - (12) Perform random wet film thickness (WFT) readings;
  - (13) Perform inspection of coatings application;
  - (14) Obtain dry film thickness (DFT) readings per [SSPC PA 2](#);
  - (15) Perform holiday testing in accordance with HOLIDAY TESTING;
  - (16) Observe label asset identification (label stickers);
  - (17) Write Correction Action Reports (CAR), if needed;
  - (18) Write Non-Conformance Reports (NCR), if needed.
- d. Writing a daily detailed summary of the work shift inspections, testing, and the day's events, including any meetings and prevalent conversations. The final daily report must include a project summary that must be part of the last daily coatings inspection report.
- e. The Coatings Contractor QC Coatings Inspector must stop all non-compliant work.

### 3.12.3 Quality Assurance Coatings Inspector's Field Responsibilities

The Quality Assurance Coatings Inspector's field responsibilities include complete documentation of all on-site work associated with the coatings project. These responsibilities include, but are not limited to, the following:

- a. Attending and documenting the pre-job meeting and acquiring the [scope of work \(SOW\) project program](#), ITP, schedule, and a list of who will receive the QC daily inspection reports;
- b. Performing a project site walk-through with the QAE or asset owner, prime Contractor, and coatings Contractor (QC Coatings Inspector and QC Manager), inspecting at least the following:
  - (1) Asset(s) to be coated;

- (2) Equipment and placement of equipment;
  - (3) Materials delivery and storage;
  - (4) Facility operational requirements during the project.
- c. Verifying all daily and hold point inspections performed by the Coatings Contractor QC Coatings Inspector or QC Manager by performing mirror inspections including, but not limited to, the following:
- (1) Verify equipment check, including blotter test to verify compressed air cleanliness;
  - (2) Verify visible contaminants testing;
  - (3) Take environmental readings;
  - (4) Perform surface preparation monitoring and testing;
  - (5) Perform surface cleanliness testing;
  - (6) Perform dust quantity test;
  - (7) Record materials storage documentation (record all coating and abrasive materials information, batch numbers, segregation, and storage temperature);
  - (8) Witness all coatings materials mixing and record mix materials temperatures, with verification of time of coatings pot life;
  - (9) Verify, witness, and record application method;
  - (10) Inspect coatings application;
  - (11) Perform dry film thickness (DFT) readings per [SSPC PA 2](#);
  - (12) Inspect asset identification (label stickers);
  - (13) Write Correction Action Reports (CAR), if needed;
  - (14) Write Non-Conformance Reports (NCR), if needed.
- d. The following testing is witnessed by the Quality Assurance Coatings Inspector and performed by the Coatings Contractor QC Coatings Inspector or QC Manager:
- (1) Wet film thickness (WFT) readings by coatings applicator(s);
  - (2) Non-visible contaminants testing for chlorides, sulfates, and nitrates (CSN);
  - (3) Abrasive field testing per [SSPC AB 1](#), [SSPC AB 2](#), or [SSPC AB 3](#);
  - (4) Holiday testing.
- e. Writing a daily detailed summary of the work shift inspections, testing, and the day's events, including any meetings and prevalent conversations. The final daily report must include a project summary

that will be part of the last daily coatings inspection report.

### 3.13 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove all foreign matter such as blast media, dust, dirt, debris, grease, and oils. Wipe all dry to handle coated surfaces with damp lint-free cloth. Remove temporary connections to Government- or Contractor- furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

Table I  
QA/QC Reporting Program Requirements

Administrative Controls:

Administrators must be able to turn on and off unique access to specific jobs and contracts.

Administrators must be able to remotely enable and disable access for users.

Administrators must be able to associate contract specific documents and specification limits quickly and easily.

Administrators must be able to associate PDS, SDS, blueprints, scope of work, and contracts uniquely to each job.

Objectivity Controls:

Data entry fields must be by multi-selectable choices, numeric keypads, pickers and skip logic to ensure repeatable data entry in a way that makes running analytics and metrics easy and objective.

Retrievable storage must be provided for all job-related reports and documents for a minimum time of five years from completion of the job or project. Archiving of the documents after five years will be the responsibility of the Government.

Document Library:

All reports must be in searchable and annotatable Portable Document Format (PDF).

Annotations and modifications must be locked and associated with the document. Only the Administrator has rights to modify or delete annotations or allow modifications to the document library especially all related inspection reports.

Customization:

The program must be capable of being customized to specific jobs, contracts or specifications.

-- End of Section --

## SECTION 09 97 13.25

MAINTENANCE, REPAIR, AND COATING OF TALL ANTENNA TOWERS  
05/11, CHG 1: 08/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 360	(2016) Specification for Structural Steel Buildings

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A320/A320M	(2021a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B231/B231M	(2016; R 2021) Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B308/B308M	(2010; R 2020) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM D1200	(2010; R 2014) Viscosity by Ford Viscosity Cup
ASTM D1640/D1640M	(2014) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D3335	(1985a; R 2020) Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy
ASTM D3718	(1985a; R 2015) Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy
ASTM D3925	(2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4285	(1983; R 2018) Indicating Oil or Water in Compressed Air
ASTM D4417	(2021) Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM F436	(2011) Hardened Steel Washers
ASTM F467	(2013; E 2014; E 2014) Standard Specification for Nonferrous Nuts for General Use
ASTM F468	(2016) Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
ASTM F593	(2017) Standard Specification for

Stainless Steel Bolts, Hex Cap Screws, and Studs

ASTM F594 (2009; R 2020) Standard Specification for Stainless Steel Nuts

ASTM F959/F959M (2017a) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series

ASTM F1077 (2005) Selection of Committee F-16 Fastener Specifications

NACE INTERNATIONAL (NACE)

NACE SP0288 (2011) Inspection of Linings on Steel and Concrete Equipment

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC A348 (2020) RCSC Specification for Structural Joints Using High-strength Bolts

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No. 4 (2007) Brush-Off Blast Cleaning

SSPC AB 2 (2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive

SSPC AB 3 (2003; E 2004) Ferrous Metallic Abrasive

SSPC Guide 12 (1998; E 2004) Guide for Illumination of Industrial Painting Projects

SSPC PA 1 (2016) Shop, Field, and Maintenance Coating of Metals

SSPC PA 2 (2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements

SSPC QP 1 (2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)

SSPC QP 3 (2010) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators

SSPC SP 1 (2015) Solvent Cleaning

SSPC SP 10/NACE No. 2 (2015) Near-White Blast Cleaning

SSPC SP COM (2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates

SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE AMS-STD-595A	(2017) Colors used in Government Procurement
U.S. DEPARTMENT OF DEFENSE (DOD)	
MIL-A-22262	(1993; Rev B; Am 1 1994; Am 2 1996; Notice 1 2021) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/19	(2009; Rev C) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type IV
MIL-PRF-85285	(2022; Rev F) Topcoat, Aircraft and Support Equipment
U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)	
EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1018	Inorganic Arsenic
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead
29 CFR 1926.1127	Cadmium
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste



40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions

## 1.2 MODIFICATIONS TO REFERENCES

In AISC 325, AISC 360, AISC 303, and RCSC A348, except as modified in this section, shall be considered a part of AISC 325 and is referred to in this section as AISC 325.

## 1.3 DESCRIPTION OF WORK

[ Provide a brief description of the work to be covered by this specification.

## ] 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

[ Steel Fabrication; G[, [\_\_\_\_]]  
 ] [ Stainless Steel Fabrication; G[, [\_\_\_\_]]  
 ] [ Aluminum Fabrication; G[, [\_\_\_\_]]

### ] SD-03 Product Data

[ Exothermic Weld Kits; G[, [\_\_\_\_]]  
 ] [ Load Indicator Washers; G[, [\_\_\_\_]]

### ] SD-05 Design Data

[ Containment System; G[, [\_\_\_\_]]

### ] SD-06 Test Reports

Non-metallic Abrasive Media; G[, [\_\_\_\_]]  
 Coatings; G[, [\_\_\_\_]]  
 Bolts, Nuts, and Washers; G[, [\_\_\_\_]]

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

Metallic Abrasive Media; G[, [\_\_\_\_\_]]

Daily inspection checklist; G[, [\_\_\_\_\_]]

Coating Sample Testing; G[, [\_\_\_\_\_]]

Recycled Metallic Abrasive Media; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Coating System; G[, [\_\_\_\_\_]]

Abrasive Media; G[, [\_\_\_\_\_]]

Coating System Compatibility; G[, [\_\_\_\_\_]]

Galvanizing; G[, [\_\_\_\_\_]]

Bolts, Nuts, and Washers; G[, [\_\_\_\_\_]]

Work plan; G[, [\_\_\_\_\_]]

Qualifications of Certified Industrial Hygienist (CIH); G[, [\_\_\_\_\_]]

Qualifications of Testing Laboratory for Coatings; G[, [\_\_\_\_\_]]

Qualifications of Testing Laboratory for Abrasive Media; G[, [\_\_\_\_\_]]

Qualifications of Coating Contractors; G[, [\_\_\_\_\_]]

[ Qualifications of Painting Shop; G[, [\_\_\_\_\_]]

] SD-08 Manufacturer's Instructions

Coating system; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Disposal of used abrasive; G[, [\_\_\_\_\_]]

### 1.5 SAFETY

The Contractor shall submit an Accident Prevention Plan as per Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

### 1.6 DELIVERY, STORAGE AND HANDLING

#### 1.6.1 Coating Materials

Ship, store and handle materials in accordance with SSPC PA 1. Maintain temperature in storage spaces between 40 and 75 degrees F. Maintain ambient air temperature more than 5 degrees F above the dew-point at all

times. During mixing of polyurethane materials, maintain relative humidity below 90 percent.

#### 1.6.2 Structural and Miscellaneous Materials

Handle, store, and protect materials in accordance with the manufacturer's recommendations. Replace damaged items with new items, or repair as approved by the Contracting Officer.

#### [1.7 EXISTING TOWER CONDITIONS

Include detailed information, from the CCS, on the condition of the tower including type of paint system, percentage of deterioration of the paint and structure, any hazardous contents of the paint such as Lead or Chromate, and any other pertinent information about exiting conditions.

#### ]1.8 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coatings manufacturer's written safety precautions shall be followed throughout the mixing, application, and curing of the coatings. During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are adequately protected from toxic and hazardous chemical agents which exceed the concentrations in OSHA 29 CFR 1910.1000[, OSHA 29 CFR 1910.1018, 29 CFR 1926.1127 and OSHA 29 CFR 1926.62]. Comply with respiratory protection requirements in OSHA 29 CFR 1910.134. Obtain the services of a certified industrial hygienist to review and approve the operations as to correctness of work procedures and personal protective equipment.

#### 1.9 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D3925, ASTM D4285, ASTM D4417, NACE SP0288, SSPC SP COM, SSPC SP 1[, SSPC 7/NACE No.4][, SSPC SP 10/NACE No. 2], SSPC PA 1, SSPC PA 2, SSPC Guide 12, [SSPC AB 2, ] and SSPC VIS 1 at the job site.

#### 1.10 PRE-APPLICATION MEETING

Prior to any surface preparation or coating operations, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, Contracting Officer representatives, coating inspector[, and coating systems manufacturer's representative] shall have a pre-application tank coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items to be addressed shall include: the work plan, the safety plan, inspection standards, inspector qualifications and tools, test procedures, environmental control system, safety plan, and test logs. Notify the Contracting Officer 10 days prior to meeting.

#### 1.11 QUALITY ASSURANCE

##### 1.11.1 Drawings: [Steel,] [Stainless Steel,] [Aluminum] Fabrication

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and

size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS standard welding symbols.

#### 1.11.2 Design Data: Coating System

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with [29 CFR 1926.59](#).

#### 1.11.3 Certificates

##### 1.11.3.1 Work Plan

A specific written plan describing in detail all phases of [structural repair, ] [electrical repair, ] [and ] coating operations. For coating work, address work sequencing, surface preparation, coating application, recoat and cure time projections, as well as how each step will be controlled, tested, and evaluated. Address safety measures, work scheduling around weather, and record keeping.

##### 1.11.3.2 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.11.3.3 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of the coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that persons performing analyses are qualified.

##### 1.11.3.4 Qualifications of Testing Laboratory for Abrasive Media

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform the testing of the abrasive media samples for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive media for conformance with specifications, and that persons performing analyses are qualified.

##### 1.11.3.5 Qualifications of Coating Contractors

[ All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of [SSPC QP 1](#) prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to

perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered, and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

]

[ Submit the name, address, telephone number, FAX number, and e-mail address of the agency that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on [ industrial steel structures] [\_\_\_\_\_] on a minimum of three separate projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility  
Employer (if other than the Contractor)  
Name of facility owner  
Mailing address, telephone number, and telex number (if non-US) of facility owner  
Name of individual in facility owner's organization who can be contacted as a reference  
Location, size and description of structure  
Dates work was carried out  
Description of work carried out on structure

#### ]1.11.3.6 [Qualifications of Painting Shop](#)

[ [SSPC QP 3](#) (enclosed shop)

#### ]1.11.3.7 [Abrasive Media](#)

Certify conformance to contract requirements and provide copies of test results required by [MIL-A-22262](#) or [SSPC AB 3](#) for material chosen.

#### 1.11.3.8 [Coating System Compatibility](#)

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. When all coating materials are manufactured by one manufacturer, this certification is not required.

#### 1.11.4 Test Reports

##### 1.11.4.1 [Non-metallic Abrasive Media](#)

Submit test results from independent laboratory of representative sample of abrasive media. Sample must have been tested within the last three years. Submit results as required in article entitled "QUALIFICATION INSPECTION" of [MIL-A-22262](#), and as revised by article entitled "ABRASIVE MEDIA" herein. Note that requirement for "QUALIFICATION INSPECTION" is a pre-qualification requirement, and involves the same testing required for listing in the Qualified Products List of the respective material. See

appropriate Military Specification for specific test requirements.

#### 1.11.4.2 Coatings

Submit test results from independent laboratory of representative samples of each coating material. Samples must have been tested within the last three years. Submit results for epoxy materials as required in article entitled "QUALIFICATION INSPECTION" of MIL-DTL-24441, and as revised by article entitled "COATING SYSTEM" herein. Submit results for polyurethane materials as required in article entitled "QUALIFICATION INSPECTION" of MIL-PRF-85285, and as revised by article entitled "COATING SYSTEM" herein. Note that requirement for "QUALIFICATION INSPECTION" is a pre-qualification requirement, and involves the same testing required for listing in the Qualified Products List of the respective material. See appropriate Military Specification for specific test requirements.

#### 1.11.4.3 Metallic Abrasive Media

Submit test results from independent laboratory testing of sample of each batch delivered to job site.

#### 1.11.4.4 Daily Inspection Checklist

Submit one copy of daily inspection checklist, completed each day when performing work under this section, to the Contracting Officer. Submit within 24 hours of date recorded on the checklist.

#### 1.11.4.5 Recycled Metallic Abrasive Media

Submit test results from independent laboratory of daily and weekly Quality Control testing required by SSPC AB 2, as modified in article entitled "ABRASIVE MEDIA."

## PART 2 PRODUCTS

### 2.1 STEEL

New steel shall be galvanized.

#### 2.1.1 Structural and Miscellaneous Steel

ASTM A36/A36M, hot dip galvanized.

#### 2.1.2 Steel Tubing and Pipe

ASTM A500/A500M, Grade B, hot dip galvanized.

### 2.2 STAINLESS STEEL

ASTM A666, Type 316, Stainless steel shall not be galvanized.

#### 2.2.1 Band Clamps

ASTM A666, Type 316.

### 2.3 ALUMINUM

#### 2.3.1 Plates and Shapes

ASTM B209, Type 6061-T6; ASTM B308/B308M

[2.3.2 Stranded Conductor

ASTM B231/B231M, Class A, 19 wire, 5/8 inch diameter strand (leg riser cables).

]2.4 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.4.1 Structural Steel

2.4.1.1 Bolts

ASTM A325, Type 1, hot dip galvanized. Bolts shall have a maximum Rockwell hardness of 32. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength, grade and type specified by ASTM specifications.

2.4.1.2 Nuts

[Provide galvanized ASTM A563 nuts, Grade and Style as specified in the applicable ASTM standard.] [Provide ASTM A563, hot dip galvanized nuts with a locking pin set in the nut. The locking pin shall slide along the bolt threads, and by reversing the direction of the locking pin, the nut shall be removed without damaging the nut or bolt. Provide noncorrosive locking pins.]

2.4.1.3 Washers

ASTM F436, hot dip galvanized steel.

[2.4.1.4 Load Indicator Washers

ASTM F959/F959M, hot dip galvanized steel.

]2.4.2 Stainless Steel

2.4.2.1 Bolts

ASTM F593, type 304

2.4.2.2 Nuts

ASTM F594, type 304

2.4.2.3 Washers

ASTM A320/A320M, except provide type 304

2.4.3 Aluminum

2.4.3.1 Bolts

ASTM F468

2.4.3.2 Nuts

## ASTM F467

## 2.4.3.3 Washers

## ASTM F1077

## 2.5 GALVANIZING

ASTM A123/A123M or ASTM A153/A153M, as applicable, unless specified otherwise. GALVANIZED SURFACES SHALL NOT BE "PASSIVATED" OR "STABILIZED".

## 2.5.1 Galvanizing Repair Compound

ASTM A780/A780M, cold galvanizing repair compound.

## 2.6 WELDING

[AWS D1.1/D1.1M for steel] [AWS D1.2/D1.2M for aluminum.]

## 2.6.1 Exothermic Weld Kits

Exothermic weld kits specifically designed by the manufacturer for welding the types of materials and shapes provided.

## 2.7 COATING SYSTEM

Alternate systems or products will not be considered.

## [2.7.1 Sealer for Thermal Spray Metallizing

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (thinned 50 percent using solvent recommended by manufacturer)). Modify requirements to include maximum allowable lead content of 0.06 percent by wt. as tested by ASTM D3335, maximum Cadmium content of 0.06 percent by wt. as tested by ASTM D3335, and maximum allowable Chromium content of 0.00 percent by wt. as tested by ASTM D3718. All other requirements of this Military Specification apply.

## ]2.7.2 Zinc Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type II). Modify requirements to include maximum allowable lead content of 0.06 percent by wt. as tested by ASTM D3335, maximum Cadmium content of 0.06 percent by wt. as tested by ASTM D3335, and maximum allowable Chromium content of 0.00 percent by wt. as tested by ASTM D3718. All other requirements of this Military Specification apply.

## ]2.7.3 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. Modify requirements to include maximum allowable lead content of 0.06 percent by wt. as tested by ASTM D3335, maximum Cadmium content of 0.06 percent by wt. as tested by ASTM D3335, and maximum allowable Chromium content of 0.00 percent by wt. as tested by ASTM D3718. All other requirements of this Military Specification apply.



## 2.7.4 Polyurethane Topcoat

Polyurethane coating topcoat of MIL-PRF-85285, Type II, White SAE AMS-STD-595A color number 17875, and Orange color number 12197.

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:

<u>Time from mix (minimum)</u>	<u>Maximum time through a No. 4 Ford cup</u>
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

All other requirements of this Military Specification apply.

## 2.8 SOLUBLE SALTS TEST KITS

## 2.8.1 Test Kit for Measuring Chlorides on Steel Surfaces

Provide test kits called CHLOR\*TEST, as manufactured by CHLOR\*RID International Inc. of Chandler, Arizona ([www.chlor-rid.com](http://www.chlor-rid.com)) or equal. To be considered for approval as an "equal" test kit, each proposed test kit shall:

- a. Be a completely self-contained test kit with all materials, supplies, tools and instructions to take tests and identity results;
- b. Use identifiable, consistent, factory pre-measured test extract solution;
- c. Provide for testing of any steel surface, regardless of orientation;
- d. Provide for testing flat, curved, smooth, pitted and rough surfaces;
- e. Provide for taking direct measurements of the chloride ion in micrograms per square centimeter without using conversion charts or tables;
- f. Be environmentally friendly and not contain any forms of mercury;
- g. Provide all new components for extraction and titration for each test;
- h. Provide an encapsulated environment while extracting chlorides;
- i. Provide a factory sealed titration device for each test;
- j. Use the extract sampling container as the titration container.

### 2.8.2 Test Kit for Measuring Chlorides in Abrasives

Provide test kits called CHLOR\*TEST-A, as manufactured by CHLOR\*RID International Inc. of Chandler, Arizona ([www.chlor-rid.com](http://www.chlor-rid.com)), or equal. To be considered for approval as an "equal" test kit, each proposed test kit shall:

- a. Be a completely self-contained test kit with all materials, supplies, tools and instructions to take tests and identify results;
- b. Use identifiable, consistent, factory pre-measured test extract solution;
- c. Provide for testing equal volumes of abrasive and test solution;
- d. Provide for taking direct measurements of the chloride ion in parts per million (PPM), without using conversion charts or tables;
- e. Provide all new components for extraction and titration for each test;
- f. Provide a factory sealed titration device for each test;
- g. Use the extract sampling container as the titration container.

### 2.9 ABRASIVE MEDIA

The referenced abrasives specifications have been modified to place additional requirements on testing for soluble salts contamination. Other factors such as on-site handling and recycling can allow contamination of abrasives. Successful testing of chlorides in abrasives does not negate the final acceptance testing of steel surfaces.

[ Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or OSHA 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

#### ]2.9.1 Non-metallic Abrasive Media

Abrasive media shall conform to MIL-A-22262, Type I (Inorganic materials) except that:

- a. The maximum allowable chloride content is 7 parts per million (ppm) as measured with the test kit described in article entitled "Test Kit for Measuring Chlorides in Abrasives."

[ b. The gross gamma radioactivity shall not exceed 5 picocuries per gram.

] Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive media that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded media. Make adjustments to processes or media gradation to achieve specified surface profile. Do not use recycled non-metallic abrasive media.

#### 2.9.2 Metallic Abrasive Media

Use abrasive media that is specifically selected and graded to provide a

sharp, angular profile to the specified depth. Make adjustments to processes, media gradation, or media hardness to achieve specified surface profile.

#### 2.9.2.1 New and Remanufactured Metallic Abrasive Media

Abrasive media shall conform to the chemical and physical properties of [SSPC AB 3](#), except that:

- a. The maximum allowable chloride content is 7 parts per million (ppm) as measured with the test kit described in article entitled "Test Kit for Measuring Chlorides in Abrasives." Modify the requirements of [SSPC AB 3](#) to substitute requirement for one chloride test for each "WATER SOLUBLE CONTAMINANTS" test required.
- b. Hardness of steel grit shall be chosen to match requirements of abrasive blasting work.

[ c. The gross gamma radioactivity shall not exceed 5 picocuries per gram.

#### ]2.9.2.2 Recycled Metallic Abrasive Media

Abrasive media shall conform to the chemical and physical properties of [SSPC AB 2](#) except that:

- a. The maximum allowable chloride content is 7 parts per million (ppm) as measured with the test kit described in article entitled "Test Kit for Measuring Chlorides in Abrasives." Modify the requirements of [SSPC AB 2](#) to substitute requirement for one chloride test for each "WATER SOLUBLE CONTAMINANTS" test required.
- b. The maximum allowable Chromium and Cadmium content of the work mix shall be 0.1 percent by wt. when tested in accordance with [ASTM D3718](#) for Chromium and [ASTM D3335](#) for Cadmium. Modify the requirements of [SSPC AB 2](#) to add requirement for one Chromate test and one Cadmium test for each "LEAD" test required.

### PART 3 EXECUTION

#### 3.1 STRUCTURAL [REPAIRS] [MODIFICATIONS]

##### 3.1.1 Fabrication

By mechanics skilled in the trade and in accordance with the manufacturer's directions. Metalwork shall be well formed to shape and size, with sharp lines, angles, and true curves. Work shall be fabricated to allow for expansion and contraction of materials. Provide welding and bracing of adequate strength and durability, with tight, flush joints, dressed smooth and clean. Prior to erection, members shall be identified with a painted erection mark.

##### 3.1.1.1 Measurements

Before fabrication, verify all measurements to ensure coordination of new members to existing tower structure.

##### 3.1.1.2 Metal Surfaces

Shall be clean and free from mill scale, flake rust and rust pitting; well

formed and finished to shape and size, with sharp lines, angles, and smooth surfaces. Shearing and punching shall leave clean true lines and surfaces. Weld permanent connections. Welds shall be used and finished flush and smooth on surfaces that will be exposed after installation.

#### 3.1.1.3 Construction

Thickness of metal and details of assembly and supports shall be as indicated. Joints exposed to weather shall be formed to exclude water.

#### 3.1.1.4 Fastening

Provide the necessary brackets so that the work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be drilled. Joints exposed to the weather shall be formed to exclude water. Conceal fastenings where possible.

#### 3.1.1.5 Shop Fabrication

Fabrication and assembly shall be done in the shop to the greatest extent possible.

#### 3.1.2 Galvanizing

New metal, except stainless steel, shall be galvanized. Galvanize after fabrication. Repair galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied. Coat inside of holes drilled in existing steel structure with cold galvanizing repair compound within 1 hour of drilling.

#### 3.1.3 Welding

Perform welding, welding inspection, and corrective welding, in accordance with [AWS D1.1/D1.1M](#) for steel and [AWS D1.2/D1.2M](#) for aluminum. Existing tower steel shall be stripped to bare metal prior to welding. Weld in a manner to prevent permanent distortion of the connected parts. Weld continuously along the entire area of contact. Provide AWS qualified welders, welding operators and tackers.

##### [3.1.3.1 Exothermic Welding

Use exothermic weld kits for connections of #3/0 AWG bare copper grounding wire.

##### ]3.1.4 Connections

Except as modified in this section, connections not detailed shall be designed in accordance with [AISC 360](#). Build connections into existing work. Punch, subpunch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

##### [3.1.4.1 Bolts

[ASTM A325](#) bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Provide load indicator washers in all high strength bolted connections. Direct tension indicator tightening, or installation of alternate design fasteners, shall be the only acceptable tightening methods. Bolts shall be installed in connection holes and initially

brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

#### ]3.1.4.2 Stainless Steel Fasteners

**ASTM F593** bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

#### [3.1.4.3 Installation of Load Indicator Washers (LIW)

**ASTM F959/F959M**. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat **ASTM F436** washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening.

### ]3.2 COATING SAMPLING AND FIELD TESTING

#### 3.2.1 Coating Sample Collection

Notify Contracting Officer three days in advance of sampling. The Contracting Officer and either the QC Manager or NACE Coating Inspector shall witness all sampling. Obtain a one quart sample of each batch of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with **ASTM D3925**. Prior to sampling, mix contents of sealed container to ensure uniformity. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. Ship samples to an approved laboratory for testing as required by paragraph entitled "Testing of Coating Samples."

#### 3.2.2 Coating Sample Testing

Test samples of all primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject samples that fail tests, reselect, and retest samples.

### 3.3 SURFACES TO BE COATED

Coat all exposed surfaces, including ladders, railings, [\_\_\_\_], and other exterior appurtenances.

#### 3.3.1 Protection of Items not to be Painted

Remove or protect all objects not to be abrasive blasted or painted. Items that are to be removed or protected are listed below:

- a. [\_\_\_\_\_]

### 3.4 ACCEPTABLE INSTALLERS

Contractors qualified in accordance with this section shall perform all surface preparation and coating application.

### 3.5 LIGHTING

Provide lighting for all work areas as prescribed in [SSPC Guide 12](#).

### 3.6 CONTAINMENT SYSTEM

The contractor shall design and provide a containment system for the capture, containment, collection, storage and disposal of the waste materials generated by the work under this contract. Waste materials covered by this paragraph shall not include any material or residue from removal of coatings containing lead, chromium, cadmium, PCB, or any other hazardous material. Submit design drawings and calculations designed by a registered engineer, including an analysis of the load which will be added to the structure by the containment system and waste materials. The review and acceptance of the containment system shall in no way relieve the contractor of any responsibility for obtaining the degree of capture, containment, and collection. It is the contractors responsibility to insure the feasibility and workability of the containment system. The contractor shall perform his operations and work schedule in a manner as to minimize leakage of the containment system. The containment system shall be properly maintained and shall not deviate from the approved drawings, without the Contracting Officers approval. If at any time during the execution of the work, the containment system fails to function satisfactory in the opinion of the Contracting Officer, the contractor shall suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations shall not resume until modifications have been made to correct the cause of the failure. Modifications shall be approved by the Contracting Officer.

#### 3.6.1 Containment System Plans

Drawings shall be a minimum of 22 inch by 36 inch with proper lettering. General notes shall be placed in the space above the title box. Show the containment system in plan and elevation views, including details of hangers and clips. Permanent attachments or fasteners to the tower shall not be allowed. Identify all containment system components on the plan sheets. Drawings shall indicate the maximum permissible loads of blast materials, waste material, and wind speeds. Indicate all framework, work platforms, scaffolding, curtains, screens, tarps, method of securement, etc.

### 3.7 Removal of Coatings Containing Hazardous Materials

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be removed in accordance with Section [02 83 00 LEAD REMEDIATION](#). Dispose of waste products including contaminated blasting grit, water, and the like. Coatings specified may have potential health hazards if ingested or improperly handled. Follow manufacturer's written safety precautions throughout the mixing, application, and cure of the coatings.

### 3.8 SURFACE PREPARATION

#### 3.8.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of [95 psig](#) at nozzle. Filter air supply so that air is free of oil and moisture in accordance with [ASTM D4285](#). Test compressed air quality at each startup, but in no case

less often than every five operating hours.

### 3.8.2 Abrasives for Soluble Salts Contamination

Test abrasive media for chloride contamination using test kit as described in article entitled "Test Kit for Measuring Chlorides in Abrasives." The maximum allowable chloride concentration is 7 ppm. Collect composite samples using techniques described in MIL-A-22262 article entitled "QUALITY CONFORMANCE INSPECTION." Test abrasive media immediately prior to use, and in no case more than 24 hours prior to use.

#### 3.8.2.1 Pre-Preparation Testing of Abrasive Media Shipped in Bulk Containers

For bulk containers containing 3000 pounds or less, test one composite sample from each container. Reject entire container for non-conforming test. For bulk containers over 3000 pounds, test one composite sample for each 3000 pounds, one sample from each compartment, as appropriate. Reject entire container or compartment for non-conforming test.

#### 3.8.2.2 Abrasive Media Shipped in Bags (Nominal 50-110 lb.)

Maintain palletized grouping as provided from supplier. Test composite sample from one bag of each pallet, but no less than one sample each 3000 pounds of abrasive. Reject entire pallet for nonconforming test. If palletized grouping is not maintained, sample and test one bag for every 1000 pounds of abrasive. Reject each 1000 pounds represented by a nonconforming test. If bags are stamped with Lot number, test composite samples from each of two bags per lot. Reject entire lot for nonconforming test.

#### 3.8.2.3 Operational Testing of Recycled Metallic Abrasive Media

For batch processing of abrasive, test composite sample of each batch. Reprocess entire batch for non-conforming test. For continuous processing, test composite sample once per cycle, but no less than one sample every four hours. For non-conforming test during continuous processing, discontinue processing, check equipment for correct operation, and check surfaces prepared with non-conforming abrasive media as prescribed in Article entitled "Pre-Application Testing For Surface Contamination." Make adjustments to equipment or to processing as required to correct problem, and resume blasting when testing indicates that equipment is operating properly.

### 3.8.3 Clean[ and Repair]

Brush-off blast all surfaces in accordance with SSPC 7/NACE No.4 to remove all corrosion products, including surface rust and pack rust. After abrasive blasting, remove abrasive and dust from surfaces by brushing, blowing with dry compressed air, and remove all loose material from vicinity of areas to be painted. [ Examine tank for defects. Repair defects found, such as cracks or splits, by welding. Grind off rough surfaces on weld seams, sharp edges, and corners to a radius of not less than 1/8 inch. Weld sharp depressions or deep pits and grind-off smooth.]

### 3.8.4 Surface Standard

Inspect surfaces to be coated, and select plate with similar characteristics and surface characteristics for use as a surface standard. Blast clean one or more 1 foot square steel panels. Surface preparation

and profile shall be as specified in paragraph entitled "SURFACE PREPARATION." Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with [ASTM D4417](#). Seal surface standard with a clearcoat protectant, or keep wrapped and sealed in vapor-tight material, for use as a standard of comparison for steel surfaces throughout the course of work.

### 3.8.5 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

#### 3.8.5.1 Pre-Preparation Testing for Oil and Grease Contamination

Ensure surfaces are oil-free by visual examination. Check entire structure with water misted onto surface. Any beading of water is indication of oil or grease contamination. Clean contaminated surfaces in accordance with [SSPC SP 1](#) and recheck for contamination until surfaces are grease and oil-free.

#### 3.8.5.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate the use of wet abrasive blasting, high pressure water washing, or water washing with a soluble salt remover that is biodegradable, noncorrosive, nontoxic, and leaves no film. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

### 3.8.6 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with [SSPC SP 10/NACE No. 2](#). Near-white metal surfaces shall conform to [SSPC VIS 1](#) and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Surface profile greater than 3 mils will not be accepted. Measure surface profile in accordance with [ASTM D4417](#). Time interval between abrasive blasting and application of primer shall not exceed eight hours. After abrasive blasting, clean surfaces of dust and debris by brushing, blowing with oil-free and moisture-free compressed air, or vacuuming.

### 3.8.7 Disposal of Used Abrasive

Dispose of used abrasive at a landfill off Government property in accordance with applicable regulations. [ Test used abrasive in accordance with EPA test procedures manual [EPA 530/F-93/004](#) and [40 CFR 261](#) to determine if it is a hazardous waste using TCLP for metals. Handle and dispose of abrasive determined to be hazardous waste in accordance with [40 CFR 260](#), [40 CFR 261](#), [40 CFR 262](#), [40 CFR 263](#), [40 CFR 264](#), [40 CFR 265](#),



40 CFR 266, and 40 CFR 268. Dispose in accordance with Section 02 83 00 LEAD REMEDIATION. Payment for disposal of hazardous waste will not be made until a completed manifest from treatment or disposal facility is returned, and a copy furnished to the Government.]

### 3.8.8 Pre-Application Testing For Surface Contamination

#### 3.8.8.1 Pre-Application Testing for Oil and Grease Contamination

Ensure surfaces are oil-free by visual examination. Check questionable areas and random areas for beading of water misted onto surface. Clean contaminated surfaces in accordance with SSPC SP 1 and recheck for contamination until surfaces are oil-free. Reblast tested and cleaned areas as required.

#### 3.8.8.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in article entitled "Test Kit for Measuring Chlorides on Steel Surfaces." Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 3000 square feet or part thereof. [ Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting.][ Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds.] One or more readings greater than 5 micrograms per square centimeter of chlorides shall be cause for rejection of surface. Wash all surfaces as discussed in article entitled "Pre-Preparation Testing for Soluble Salts Contamination," allow to dry, and re-test until all required tests show allowable results. Reblast tested and cleaned areas as required. Label all test tubes and retain for test verification.

#### 3.8.8.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Clean contaminated surfaces and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 3000 square feet or part thereof.

### 3.9 MIXING AND APPLICATION OF COATING SYSTEM

#### 3.9.1 Preparation of Coating Materials for Application

Each of the epoxy and polyurethane products, [sealer, ][primer], intermediate, and topcoat, is a two-component coating supplied in separate containers.

##### 3.9.1.1 Mixing [Sealer, ][Primer, ]Intermediate, and Topcoat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits or alter mix ratios. Mix all coating materials in same temperature and humidity conditions specified in article entitled "DELIVERY AND STORAGE." Allow epoxy material to stand for required induction time based on its temperature. Keep coating material containers covered at all times after mixing and during application to prevent contamination. The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life.

### 3.9.1.2 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Do not add solvent to extend pot life. Add all required solvent at time of mixing. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop it is approximately doubled. Other factors such as the shape of the container and volume of mixed material may also affect pot life. Precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times at 70 degrees F:

Epoxy materials	4 hours
Polyurethane materials	2 hours.

### 3.9.1.3 Application Conditions and Recoat Windows

The overcoating requirements for the coating system are very time and temperature sensitive. If ambient conditions do not allow for orderly application of primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling surface temperatures, as required. Partial or total enclosures may be required, as well as other measures, to control conditions to allow for orderly application of all required coats.

Apply coating only when ambient air and steel temperatures are between 60 and 100 degrees F, and steel surface temperature is more than 5 degrees F above the dew-point of the ambient air during application and the first four hours for epoxy and the first eight hours for polyurethane. Do not apply coatings above 100 degrees F or below 60 degrees F.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coating during appropriate RECOAT WINDOW.

If coating is not applied during RECOAT WINDOW, apply during EXTENDED RECOAT WINDOW. Application of any epoxy coat within the EXTENDED RECOAT WINDOW requires application of a TACK COAT prior to applying any full coat. Perform cure test immediately prior to application of TACK COAT to determine condition of applied coating. If CURE TEST indicates that surface is fully cured, provide GLOSS REMOVAL prior to application of TACK COAT.

If coating is not applied during EXTENDED RECOAT WINDOW, wash surface with water and detergent, rinse clean with fresh water and allow surface to dry thoroughly, provide GLOSS REMOVAL, apply TACK COAT, where applicable, within 24 hours, and apply next full coat within TACK COAT RECOAT WINDOW.



<u>RECOAT WINDOWS</u>						
EPOXY OVER EPOXY						
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
EXTENDED RECOAT (Hrs.)	72-168	60-140	48-120	36-96	18-36	6-12
TACK COAT RECOAT WINDOW (Hrs.)	6-72	4-60	4-48	3-36	2-18	1-6
POLYURETHANE OVER EPOXY						
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
EXTENDED RECOAT (Hrs.)	96-168	72-144	48-120	36-96	24-48	16-24
TACK COAT RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
POLYURETHANE OVER POLYURETHANE						
Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2
EXTENDED RECOAT (Hrs.)	NONE					
TACK COAT RECOAT WINDOW (Hrs.)	NO TACK COAT USED					

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

CURE TEST - Where indicated, test surface for cure using high-flash aromatic Naphtha only (cas #64742-95-6). Do not use aliphatic VMP Naphtha. Wipe surface with rag saturated with Naphtha, and check for surface tackiness, loss of gloss, or other indications that solvent has softened surface. If softening is found on 95 percent of test sites, this is indication that coating has not fully cured, and GLOSS REMOVAL is not required if TACK COAT is applied within three hours and full coat is applied within the TACK COAT RECOAT WINDOW. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 3000 square feet or part thereof.

TACK COAT - Where indicated, apply coat of intermediate coat epoxy, at 1 to 2 mils WFT, then apply next specified full coat within TACK COAT RECOAT WINDOW. Thin TACK COAT material approximately 25 percent by volume, using appropriate epoxy thinner.

GLOSS REMOVAL - Where indicated, remove all gloss by brush-off abrasive blasting in accordance with SSPC 7/NACE No.4 or by hand sanding with 150-200 grit wet/dry sandpaper, pressure wash or wipe down with a clean rag soaked with denatured alcohol to remove dust. If zinc primer coat is brush-off abrasive blasted, touch-up or overcoat as required to restore zinc coating to 100 percent coverage of steel surfaces, to the specified primer coat thickness.

### 3.9.2 Application of Coating System

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in article entitled "Pre-Application Testing For Surface Contamination," as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. Apply all other coats by

[spray ] [brush, roller, or mitt] application. Use appropriate controls to prevent airborne coating fog from drifting beyond [ 15 ] [ ] feet from the structure perimeter]. Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

#### [3.9.2.1 Sealer Coat for Spray Metalizing

Apply sealer coat at 1 to 2 mils dry film thickness (DFT).

#### ] [3.9.2.2 Application of Primer

Apply primer coat at 2 to 4 mils dry film thickness (DFT). Maintain paint supply container height within 3 feet of the paint nozzle when applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

#### ] 3.9.2.3 Application of Stripe Coat

Apply a stripe coat of succeeding coat epoxy material within RECOAT WINDOW of primer coat. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

#### [3.9.2.4 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of [sealer] [primer] coat. Apply intermediate coat 3 to 5 mils DFT. Check coating thickness prior to application of topcoat. If additional coating film is required, use intermediate coating material to provide desired thickness, then apply topcoat.

#### ] 3.9.2.5 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Making Spot Repairs" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. Apply polyurethane topcoat 1-1/2 to 2-1/2 mils DFT. Total system of primer, intermediate, and topcoat shall not be less than 9 mils DFT. Apply additional topcoat, if necessary, to obtain required minimum total system thickness.

#### 3.9.2.6 Procedure for Making Spot Repairs

Use this procedure only with written approval from the Contracting Officer. Observe all requirements for soluble salts contamination and cleanliness between coats. Apply each coat within RECOAT WINDOW of preceding coat. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 3 inches beyond the prepared area with clean denatured alcohol. Within four hours of preparation, apply zinc-rich primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat by spray to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

#### 3.10 FIELD TESTS AND INSPECTION

### 3.10.1 NACE Coating Inspector

The NACE Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of coating system, and during all repair work.

### 3.10.2 Field Inspection

The NACE Coating Inspector shall accomplish field inspection. Use the Daily Inspection Checklist forms attached to the end of this section, or a similar checklist with all pertinent data included. Record all surface preparation and coating application work accomplished, environmental conditions during this work, and results of regular inspections. Record all deviations from specifications. Accomplish testing in accordance with [NACE SP0288](#) and as required herein.

#### 3.10.2.1 Thickness Testing

Following application of each coat, inspect surfaces in presence of the Contracting Officer for pinholes, blisters, inadequate coating thickness, and other defects. Repair imperfections found. Measure dry film thickness in accordance with [SSPC PA 2](#) Provide additional coating where required.

### 3.10.3 Hold Points for Quality Control Inspections

Provide appropriate QC inspections at the following hold-points:

<u>Step</u>	<u>Action</u>
Prior to preparation of surfaces for cleaning and repair	Safety inspection
After cleaning of structure and prior to surface preparation	Safety inspection, removal of dirt, trash, debris, and any hindrance to specified work.
After cleaning of structure and prior to abrasive blasting	Surface inspection for oil, grease, soluble salts, or other contaminants
Initiation of abrasive blasting, and at each work stoppage	1.) Confirm environmental conditions are suitable for abrasive blasting and for holding the blast.
	2.) Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "SURFACE PREPARATION", including visual cleanliness, surface profile, and soluble salt contamination.
	3.) Test compressor air for oil and water contamination.
After abrasive blasting	Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "SURFACE PREPARATION", including visual cleanliness, surface profile, and soluble salt contamination.



<u>Step</u>	<u>Action</u>
Immediately prior to coating application - provide for each coating application evolution	1.) Confirm environmental conditions are suitable for coating application per
	2.) Surface inspection to insure all aspects of surface preparation are properly addressed, as specified in article entitled "SURFACE PREPARATION", including visual cleanliness, surface profile, and soluble salt contamination.
	3.) Confirm that testing equipment for monitoring for hazardous conditions during coating application are working properly and are prepared for use as outlined in contractor's Safety Plan
During and after coating application.	Coating application inspection per paragraphs entitled "Application of Coating System" and "Field Tests and Inspection".
After final cleanup	Clean-up inspection specified in the paragraph entitled "Final Cleanup."

3.11 ELECTRICAL WORK

3.11.1 Terminating Aluminum Stranded Conductors

- a. Use particular care in making up joints and terminations. Remove surface oxides by cleaning with a wire brush or emery cloth. Apply joint compound to conductors, and use UL-listed solid aluminum connectors for connecting aluminum to aluminum conductors.
  
- b. Terminate aluminum conductors to existing steel tower structure using a circumferential compression type, aluminum bodied terminal lug UL listed for AL/CU and steel Belleville spring washers, flat washers, bolts, and nuts. Belleville spring washers shall be cadmium-plated hardened steel. Surface of existing steel where connection is to be made shall be stripped free of paint. Special care shall be taken to avoid destruction of underlying galvanized surface. Install the Belleville spring washers with the crown up toward the nut or bolt head, with the concave side of the Belleville bearing on a heavy-duty, wide series flat washer of larger diameter than the Belleville. Tighten nuts sufficient to flatten Belleville and leave in that position. Lubricate hardware with joint compound prior to making connection. Wire brush and apply joint compound to conductor prior to inserting in lug.

- c. Terminate aluminum conductors to aluminum bus by using all-aluminum nuts, bolts, washers, and lugs. Wire brush and apply joint compound to conductor prior to inserting in lug. Lubricate hardware with joint compound prior to making connection; if bus contact surface is unplated, scratch-brush and coat with joint compound (without grit).

### 3.12 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

[

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [            ]. - Zinc Rich Epoxy Primer Coat <a href="#">MIL-DTL-24441/19</a> Formula 159						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent (zinc dust)	---	---	81.5	85.5	---	---
Volatiles, percent	42.8	44.3	8.0	8.4	---	---
Non-volatiles vehicle, percent	53.7	57.7	8.3	8.7	---	---
Consistency, grams	---	---	250	500	---	---
Weight						
Kilograms / liter	0.87	1.01	3.30	3.40	---	---
Pounds / gallon	7.3	8.4	27.5	28.4	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Flashpoint						
Degrees C	35.6	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [        ]. - Zinc Rich Epoxy Primer Coat <a href="#">MIL-DTL-24441/19</a> Formula 159						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Titanium Dioxide, percent of pigment	18	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
VOC						
Grams / liter	---	---	---	---	---	304
Pounds / gallon	---	---	---	---	---	2.5
Lead, * percent, <a href="#">ASTM D3335</a>						0.06
Cadmium, * percent, <a href="#">ASTM D3335</a>						0.06
Chromium, * percent, <a href="#">ASTM D3718</a>						0.00
GENERAL NOTES: Test methods as specified in <a href="#">MIL-DTL-24441</a> , except those marked with "*". Where "Conform" is indicated, refer to specific requirements of <a href="#">MIL-DTL-24441</a> .						

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[

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [_____] - Intermediate Epoxy Coat <a href="#">MIL-DTL-24441/31</a> Formula 152 Type IV (White)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	44.0	49.0	---	---
Course particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms / liter	1.39	1.45	1.29	1.35	---	---
Pounds / gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [ ] - Intermediate Epoxy Coat MIL-DTL-24441/31 Formula 152 Type IV (White)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Contrast ratio, 3 miles DFT	---	---	---	---	0.98	---
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of standard color chip	---	---	---	---	---	340
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
Lead, * percent, ASTM D3335	---	---	---	---	---	0.06
Cadmium, * percent, ASTM D3335	---	---	---	---	---	0.06
Chromium, * percent, ASTM D3718	---	---	---	---	---	0.00
<p>GENERAL NOTES:                      Test methods as specified in MIL-DTL-24441, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441.</p>						

]

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [            ]. - Intermediate Epoxy Coat <a href="#">MIL-DTL-24441/31</a> Formula 152 <u>Type IV (Tinted)</u>						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatiles vehicle, percent	17.5	23.5	44.0	49.0	---	---
Course particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	---	---
Weight						
Kilograms / liter	1.39	1.45	1.29	1.35	---	---
Pounds / gallon	11.6	12.1	10.8	11.3	---	---
Set to touch, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry-hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint						
Degrees C	35.5	---	37.8	---	---	---
Degrees F	96	---	100	---	---	---
Titanium Dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Contrast ratio, 3 miles DFT	---	---	---	---	0.98	---



TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [ ] - Intermediate Epoxy Coat MIL-DTL-24441/31 Formula 152 Type IV (Tinted)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Sag resistance						
Micrometers	---	---	---	---	300	---
Mils	---	---	---	---	12	---
Color of dry film to approximate color of standard color chip	---	---	---	---	---	Conform
VOC						
Grams / liter	---	---	---	---	---	340
Pounds / gallon	---	---	---	---	---	2.8
Lead, * percent, ASTM D3335	---	---	---	---	---	0.06
Cadmium, * percent, ASTM D3335	---	---	---	---	---	0.06
Chromium, * percent, ASTM D3718	---	---	---	---	---	0.00
GENERAL NOTES: Test methods as specified in MIL-DTL-24441, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of MIL-DTL-24441.						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table I [ ] - Polyurethane Topcoat MIL-PRF-85285 Type II						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Moisture content, percent	---	2	---	---	---	---
Course particles, percent	---	---	---	---	---	.5
Viscosity	---	---	---	---	---	See Note 1
Fineness of grind, Hegman	---	---	---	---	7	---
Drying to touch (See Note 2)	---	---	---	---	---	4
Dry-hard (See Note 2)	---	---	---	---	---	8
VOC, grams per liter	---	---	---	---	---	340
Color	---	---	---	---	delta E+-1.0	
Gloss 60 degree specular gloss						
Gloss	---	---	---	---	---	90
Semi-gloss	---	---	---	---	15	45
Opacity	---	---	---	---	0.95	---
Flexibility	---	---	---	---	---	Conform
Fluid resistance	---	---	---	---	---	Conform
Heat resistance (cure)	---	---	---	---	---	Conform
Solvent resistance (cure)	---	---	---	---	---	Conform
Condition in container	---	---	---	---	---	Conform

TABLE I														
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS														
Table I [        ]. - Polyurethane Topcoat <a href="#">MIL-PRF-85285</a> Type II														
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>									
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>								
Odor	---	---	---	---	---	Conform								
Lead percent	---	---	---	---	---	0.06								
Cadmium percent	---	---	---	---	---	0.06								
Chromium percent	---	---	---	---	---	0.00								
<p>NOTES:</p> <p>(1) Modify paragraph 3.6.4 Viscosity and Pot Life, of <a href="#">MIL-PRF-85285</a> as follows:</p> <p>The viscosity of the admixed coating, when tested in accordance with <a href="#">ASTM D1200</a> through a No. 4 Ford cup, shall be as follows:</p> <table border="1"> <thead> <tr> <th>Time from mix (minimum)</th> <th>Maximum time through a No. 4 Ford Cup</th> </tr> </thead> <tbody> <tr> <td>Initially</td> <td>30 seconds</td> </tr> <tr> <td>2 hours</td> <td>60 seconds</td> </tr> <tr> <td>4 hours</td> <td>No gel</td> </tr> </tbody> </table> <p>(2) Modify paragraph 3.7.1 Drying Time, of <a href="#">MIL-PRF-85285</a>. When applied by spray techniques and when tested in accordance with <a href="#">ASTM D1640/D1640M</a>, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).</p>							Time from mix (minimum)	Maximum time through a No. 4 Ford Cup	Initially	30 seconds	2 hours	60 seconds	4 hours	No gel
Time from mix (minimum)	Maximum time through a No. 4 Ford Cup													
Initially	30 seconds													
2 hours	60 seconds													
4 hours	No gel													
<p>GENERAL NOTES:</p> <p>Test methods as specified in <a href="#">MIL-PRF-85285</a>, except those marked with "*". Where "Conform" is indicated, refer to specific requirements of <a href="#">MIL-PRF-85285</a>.</p>														

DAILY INSPECTION CHECKLIST			
<u>ITEM</u>			<u>REPORT #</u>
<u>SPECIFIC LOCATION</u>	<u>SAT</u>	<u>UNSAT</u>	<u>COMMENTS</u>
I. PRE-SURFACE PREPARATION			
1. Condition of Edges, Welds, etc.			
2. Grease / Oil			
3. Visible Moisture			
4. Protective Coverings			
5. Clean Dry Abrasive			
6. Recycled Abrasive Test			
7. Nozzle Air Pressure (Record)			
8. Compressed Air Cleanliness (Record)			
9. Ambient Conditions (Record)			Time of day:
II. SURFACE PREPARATION			Wet Bulb: Humidity Dry Bulb: Dew Pt.: Amb. Air: Surf Temp:
10. Ambient Conditions (Record)			
11. Degree of Cleanliness (Record)			
12. Profile (Record)			
13. Type and Size Abrasive (Record)			
14. Dust and Abrasive Removal			
15. Time of Surface Acceptance			
III. MIXING			Product Name: Mfg: Batch Number:
16. Product Name / Mfg / Batch Numbers (Records)			
17. Clean Equipment			

DAILY INSPECTION CHECKLIST			
<u>ITEM</u>			<u>REPORT #</u>
<u>SPECIFIC LOCATION</u>	<u>SAT</u>	<u>UNSAT</u>	<u>COMMENTS</u>
18. Material Temperature / Potlife (Record)			
19. Thinner / Type and Amount (Record)			
20. Time of Mix (Record)			
IV. APPLICATION: 21. Ambient Conditions (Record) Time of Day:			Wet Bulb: Humidity Dry Bulb: Dew Pt.: Amb. Air: Surf Temp:
22. Applicator's Name (Record)			
23. Surface Prep. to Application (Record Time)			
24. Compressed Air Cleanliness			
25. Protective Coverings			
26. Time Application Began & Surf. Temp. (Record)			
27. Surrounding Air Cleanliness			
28. Recoat Times Observed			
29. Intercoat Cleanliness			
30. Proper Pot Agitation			
31. Type of Application Equip. & Tip Size (Record)			
32. Time Application Complete and Surf. Temp (Record)			
V. INSPECTION			
33. Visual Appearance			
34. Dry Film Thickness (Record)			
35. Holiday Test			

DAILY INSPECTION CHECKLIST			
<u>ITEM</u>			<u>REPORT #</u>
<u>SPECIFIC LOCATION</u>	<u>SAT</u>	<u>UNSAT</u>	<u>COMMENTS</u>
36. Cure Test			
NOTES: (use additional sheets as necessary)			
NACE INSPECTOR	NACE NUMBER	DATE	
QC MANAGER			DATE

-- End of Section --

## SECTION 09 97 13.27

## HIGH PERFORMANCE COATING FOR STEEL STRUCTURES

02/21, CHG 1: 08/22

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D1200	(2010; R 2014) Viscosity by Ford Viscosity Cup
ASTM D1640/D1640M	(2014) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D3276	(2015; E 2016) Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D3925	(2002; R 2015) Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4285	(1983; R 2018) Indicating Oil or Water in Compressed Air
ASTM D7127	(2017) Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces using a Portable Stylus Instrument
ASTM E11	(2022) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2015) Quality Management Systems-Requirements
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## SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC AB 2	(2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2003; E 2004) Ferrous Metallic Abrasive
SSPC Guide 6	(2015) Guide for Containing Surface Preparation Debris Generated During Paint

## Removal Operations

SSPC Guide 12	(1998; E 2004) Guide for Illumination of Industrial Painting Projects
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC PA 2	(2015; E 2018) Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC QP 5	(2012) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC SP COM	(2016; E 2017) Surface Preparation Commentary for Steel and Concrete Substrates
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

## SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement
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## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(1993; Rev B; Am 1 1994; Am 2 1996; Notice 1 2021) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/19	(2009; Rev C) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type IV



MIL-PRF-85285	(2022; Rev F) Topcoat, Aircraft and Support Equipment
MIL-STD-161	(2005; Rev G; Notice 1 2010) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1926.59	Hazard Communication

## 1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the paragraph where used, and denoted by capital letters.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-05, Design Data

## Containment System

## SD-06 Test Reports

## Joint Sealant Qualification Test Reports

## Coatings Qualification Test Reports

## Metallic Abrasive Qualification Test Reports

## Coating Sample Test Reports

## Abrasive Sample Test Reports

## Inspection Report Forms

## Daily Inspection Reports

## Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

## SD-07 Certificates

## Contract Errors, Omissions, and Other Discrepancies

## Corrective Action Procedures

Coating Work Plan

Qualifications of Certified Industrial Hygienist (CIH)

Qualifications Of Individuals Performing Abrasive Blasting

Qualifications of Certified Protective Coatings Specialist (PCS)

Qualifications of Coating Inspection Company

Qualifications of QC Specialist Coating Inspector

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Qualifications of Coating Contractors

Joint Sealant Materials

Coating Materials

Coating System Component Compatibility

Non-metallic Abrasive

Metallic Abrasive

SD-08 Manufacturer's Instructions

Joint Sealant Instructions

Coating System Instructions

SD-11 Closeout Submittals

Disposal of Used Abrasive

Inspection Logbook; G[, [\_\_\_\_\_]]

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the Coating Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution. Schedule time (Float) should be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

##### 1.4.2 Corrective Action (CA)

CA shall be included in the Quality Control Plan.

#### 1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated. Develop Corrective Action Request (CAR) forms for initiating CA, and for tracking and documenting each step.

#### 1.4.2.2 Implement Corrective Action

The Contractor shall take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These procedures shall apply to non-compliance in the work, and to non-compliance in the QC System. Corrective actions shall be appropriate to the effects of the non-compliance encountered. Each CAR shall be serialized, tracked in a Log to completion and acceptance by the Contracting Officer, and retained in project records. The Corrective Action Log, showing status of each CAR, shall be submitted to the Contracting Officer monthly. A CAR may be initiated by either the Contractor or the Contracting Officer. The Contracting Officer must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

#### 1.4.3 Coating Work Plan

This work plan shall be considered as part of the Quality Control Plan.

Provide procedures for reviewing contract documents immediately after award to identify errors, omissions, and discrepancies so that any such issues can be resolved prior to project planning and development of detailed procedures.

Provide procedures for verification of key processes during Initial Phase to ensure that contract requirements can be met. Key processes shall include surface preparation, coating application and curing, inspection, and documentation, and any other process that might adversely impact orderly progression of work.

Provide procedures for all phases of coating operations, including planned work, rework, repair, inspection, and documentation. Address mobilization and setup, surface preparation, coating application, coating initial cure, tracking and correction of noncompliant work, and demobilization. Coordinate work processes with health and safety plans and confined space entry plans. For each process, provide procedures that include appropriate work instructions, material and equipment requirements, personnel qualifications, controls, and process verification procedures. Provide procedures for inspecting work to verify and document compliance with contract requirements, including inspection forms and checklists, and acceptance and rejection criteria.

- [ Provide procedures for determining the existing surface profile under paint, and procedures for ensuring that the profile is not increased beyond the maximum profile specified herein.
- ] Provide procedures for correcting noncompliant work. Detailed procedures are required in advance to avoid delays in meeting overcoat windows as well as to avoid delays in production. Provide procedures for repairing defects

in the coating film, such as runs, drips, sags, holidays, overspray, as well as how to handle correct coating thickness noncompliance, any other areas of repair or rework that might be adversely affected by delays in preparing and approving new procedures.

If a procedure is based on a proposed or approved request for deviation, the deviation shall be referenced. Changes to procedures shall be noted by submittal number and date approved, clearly delineating old requirements and new requirements, so that the records provide a continuous log of requirements and procedures.

#### 1.4.4 Design Data

##### 1.4.4.1 Containment System

Submit complete design drawings and calculations for the scaffolding and containment system, including an analysis of the loads which will be added to the structure by the containment system and waste materials. A registered engineer shall approve calculations and scaffold system design.

#### 1.4.5 Test Reports

##### 1.4.5.1 Joint Sealant Qualification Test Reports

Submit test results from independent laboratory of representative samples of joint sealant material. Samples must have been tested within the last three years. Submit results as required in paragraph QUALITY ASSURANCE PROVISIONS of [ASTM C920](#). Note that testing in accordance with QUALITY ASSURANCE PROVISIONS is a pre-qualification requirement.

##### 1.4.5.2 Coatings Qualification Test Reports

Submit test results from independent laboratory of representative samples of each coating material. U.S. Department of Defense laboratories are considered to be independent laboratories for purposes of compliance with "QUALIFICATION INSPECTION" requirements herein. Samples must have been tested within the last three years. Submit results for epoxy materials as required in paragraph QUALIFICATION INSPECTION of [MIL-DTL-24441](#), and as revised by paragraph COATING SYSTEM herein. Submit results for polyurethane materials as required in paragraph QUALIFICATION INSPECTION of [MIL-PRF-85285](#), and as revised by paragraph COATING SYSTEM herein. Note that requirement for QUALIFICATION INSPECTION is a pre-qualification requirement, and involves the same testing required for listing in the Qualified Products List of the respective material. See appropriate Military Specification for specific test requirements.

##### 1.4.5.3 Metallic Abrasive Qualification Test Reports

Submit results for abrasive as required in paragraph 4 REQUIREMENTS of [SSPC AB 3](#). Submit test results from independent laboratory of representative samples of each abrasive to be used on the jobsite. Samples must have been tested within the last three years. Note that this testing is for the purpose of prequalifying the abrasive.

##### 1.4.5.4 Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)

Submit test results from independent laboratory of daily and weekly Quality Control testing required by [SSPC AB 2](#), as modified in paragraph ABRASIVE.

#### 1.4.6 Qualifications

##### 1.4.6.1 Qualifications of Certified Industrial Hygienist (CIH)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party CIH. Submit documentation that hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification. Provide evidence of experience with hazards involved in industrial coating application work.

##### 1.4.6.2 Qualifications of Certified Protective Coatings Specialist (PCS)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party PCS. Submit documentation that specialist is certified by SSPC: The Society for Protective Coatings (SSPC) as a PCS, including certification number and date of certification/recertification. If the PCS is employed by the same coating inspection company to which the coating inspector is employed, this does not violate the independent third-party requirements. The PCS shall remain certified during the entire project, and the Contracting Officer shall be notified of any change in certification status within 10 days of the change. The PCS shall not be the designated coating inspector.

##### 1.4.6.3 Qualifications of Coating Inspection Company

Submit documentation that the coating inspection company that will be performing all coating inspection functions is certified by SSPC to the requirements of **SSPC QP 5** prior to contract award, and shall remain certified while accomplishing any coating inspection functions. The coating inspection company must remain so certified for the duration of the project. If a coating inspection company's certification expires, the firm will not be allowed to perform any inspection functions, and all surface preparation and coating application work must stop, until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in coating inspection company certification status.

##### 1.4.6.4 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to **SSPC QP 5**, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

##### 1.4.6.5 Qualifications Of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by SSPC to the SSPC C-7 Dry Abrasive Blaster Qualification Program. Each blaster shall remain qualified during the entire period of abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status.

##### 1.4.6.6 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of

coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that persons performing analyses are qualified.

#### 1.4.6.7 [Qualifications of Testing Laboratory for Abrasive](#)

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that persons performing analyses are qualified.

#### 1.4.6.8 [Qualifications of Coating Contractors](#)

All Contractors and Subcontractors that perform surface preparation or coating application shall be certified to either [ISO 9001](#) or [SSPC QP 1](#) and [SSPC QS 1](#) prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting Contractors and painting Subcontractors must remain so certified for the duration of the project. If a Contractor's or Subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in Contractor certification status.

#### 1.4.6.9 [Joint Sealant Materials](#)

Provide manufacturer's certification of conformance to contract requirements.

#### 1.4.6.10 [Coating Materials](#)

Provide manufacturer's certification of conformance to contract requirements.

#### 1.4.6.11 [Coating System Component Compatibility](#)

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. When all coating materials are manufactured by one manufacturer, this certification is not required.

#### 1.4.6.12 [Non-metallic Abrasive](#)

Provide manufacturer's certification that the materials are currently approved by the Naval Sea Systems Command and listed on the Qualified Products Lists (QPL) for the specified materials.

#### 1.4.6.13 [Metallic Abrasive](#)

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results.

#### 1.4.7 Protective Coating Specialist (PCS)

The PCS shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The PCS shall approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

#### 1.4.8 Pre-Application Meeting

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, coating inspector, and PCS shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: corrective action requirements and procedures, coating work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

### 1.5 PRODUCT DATA

#### 1.5.1 Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed application procedures, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

#### 1.5.2 Coating System Instructions

Submit manufacturer's printed instructions including detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

### 1.6 DELIVERY AND STORAGE

Ship, store, and handle materials in accordance with SSPC PA 1, and as modified in this Section. Maintain temperature in storage spaces between 40 and 85 degrees F, and air temperature more than 5 degrees F above the dew-point at all times. Inspect materials for damage prior to use and return non-compliant materials to manufacturer. Remove materials with expired shelf life from government property immediately and notify the Contracting Officer.

If materials are approaching shelf life expiration and an extension is desired, samples may be sent to the manufacturer, along with complete records of storage conditions, with a request for shelf life extension. If the manufacturer finds the samples and storage data suitable for shelf life extension, the manufacturer may issue an extension, referencing the product evaluation and the review of storage records. Products may not be extended longer than allowed in the product specification.

### 1.7 COATING HAZARDS

Ensure that employees are trained in all aspects of the safety plan. Specified coatings may have potential health hazards if ingested or improperly handled. The coating manufacturer's written safety precautions shall be followed throughout mixing, application, and curing of the coatings. During all cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are protected from toxic and hazardous chemical agents which exceed concentrations in 29 CFR 1910.1000. Comply with respiratory protection requirements in 29 CFR 1910.134. The CIH shall approve work procedures and personal protective equipment.

#### 1.8 JOB SITE REFERENCES

Make available to the Contracting Officer at least one copy each of ASTM D3276, ASTM D3925, ASTM D4285, ASTM D7127, SSPC SP COM, SSPC SP 1, SSPC 7/NACE No.4, SSPC SP 10/NACE No. 2, SSPC PA 1, SSPC PA 2, SSPC Guide 6, SSPC VIS 1, SSPC QP 1, SSPC QS 1, and an SSPC Certified Contractor Evaluation Form at the job site.

### PART 2 PRODUCTS

#### 2.1 JOINT SEALANT

TT-S-00230, Type II, Class B

#### 2.2 COATING SYSTEM

Alternate systems or products will not be considered. Provide a complete system (primer, intermediate coat, top coat) material from one supplier.

[ Apply the entire coating system in the field. Remove all shop-applied primer prior to final field surface preparation and coating system application. Adjust all shop preparation to avoid conflicts with final surface preparation requirements.

] [Prepare surface and apply the complete coating system in the shop. Follow all temperature, humidity, and testing requirements listed herein.

] The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to contract award, as indicated in paragraph 3.2 of MIL-DTL-24441 and paragraph 3.1 of MIL-PRF-85285. Testing of products by an independent laboratory to the QUALIFICATION INSPECTION requirements of MIL-DTL-24441 and MIL-PRF-85285 prior to contract award is required. See specific submittal requirements in paragraph QUALITY ASSURANCE.

##### 2.2.1 Zinc-Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type III).

##### 2.2.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

##### 2.2.3 Polyurethane Topcoat



Polyurethane coating topcoat of MIL-PRF-85285, Type II, [White SAE AMS-STD-595A color number 17925] [Beige SAE AMS-STD-595A color number 27769 in gloss] [White SAE AMS-STD-595A color number 17875, and Orange SAE AMS-STD-595A color number 12197].

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

#### [2.3 COLOR IDENTIFICATION OF FUEL HANDLING AND STORAGE FACILITIES

Piping, conduit, and tank identification shall be in accordance with MIL-STD-161. Mark direction of fluids in accordance with MIL-STD-161. The NATO symbol for JP-8 is F-34.

#### ]2.4 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to be shipped, and packing material. Mark cans for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

#### 2.5 ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one suitable plastic bag or container for each sample to be collected. Mark containers for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

#### 2.6 TEST KITS

##### 2.6.1 Test Kit for Measuring Chloride, Sulfate and Nitrate Ions on Steel and Coated Surfaces

Provide test kits that meet all of the following requirements:

- a. Contains all materials, supplies, tools, and instructions for field

testing and on-site quantitative evaluation of chloride, sulfate, and nitrate ions;

- b. Extract solution is acidic, factory pre-measured, pre-packaged, and of uniform concentration;
- c. Components and solutions are mercury free and environmentally friendly;
- d. Contains new materials and solutions for each test extraction;
- e. Contains an extraction test container (vessel, sleeve, cell) that creates a sealed, encapsulated environment during salt ion extraction;
- f. Contains a test extract container suitable for testing the following steel surfaces: horizontal (up/down configuration), vertical, flat, curved, smooth, pitted, and rough;
- g. All salt ion concentrations are directly measured in micrograms per square centimeter.

#### 2.6.2 Test Kit for Identifying Amine Blush on Epoxy Surfaces

Provide test kits that meet all of the following requirements:

- a. Is a completely self-contained field test kit with all materials, supplies, tools, and instructions to perform tests and indicate the presence of unreacted amines;
- b. Uses an identifiable, consistent, uniform, pre-packaged, factory pre-measured indicating solution;
- c. Contains no mercury or lead and is environmentally friendly;
- d. Contains a solution of an unreacted amine for the purpose of "self checking" the indicator solution;

#### 2.7 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

[ Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.  
]

##### 2.7.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials) [ except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Abrasive shall be approved by the Naval Sea Systems Command and listed on the

appropriate Qualified Products List (QPL) for the specified materials. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

2.7.2 Metallic Abrasive

2.7.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 Class 1 (Steel) only[, except that the gross gamma radioactivity shall not exceed 5 picocuries per gram]. Class 2 (Iron) abrasive shall not be used.

To develop a suitable work mix from new steel abrasive, a minimum of 200 - 400 recycles is required, therefore, it is advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project. Such grit shall be considered to conform if it can be traced to new grit conforming to SSPC AB 3 Class 1 and it meets all cleanliness requirements of SSPC AB 3 Class 1 when brought to the current jobsite. Submit one representative sample of this work mix to the laboratory for testing, along with samples of new material. Acceptance and use of this work mix shall not be used to justify any deviation from surface preparation requirements.

2.7.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

2.8 WHITE ALUMINUM OXIDE NON-SKID GRIT

Size #60, dust free (washed and dry), minimum 99 percent pure, having the following sieve analysis when tested in accordance with ASTM E11 using a 2.2 pound sample:

Sieve #	Percent Retained
40	0
50	15-40
60	60-85

PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coating Work Plan.

[3.1 REMOVAL OF COATINGS CONTAINING HAZARDOUS MATERIALS

Coatings containing hazardous materials and identified for disturbance during surface preparation, including removal, shall be handled in accordance with Section 02 83 00 LEAD REMEDIATION. Coordinate surface preparation requirements from Section 02 83 00 LEAD REMEDIATION with this Section.

### ]3.2 COATING AND ABRASIVE SAMPLE COLLECTION AND TESTING

Sample and test materials delivered to the jobsite. Notify Contracting Officer three days in advance of sampling. The QC Manager and either the PCS or coating inspector shall witness all sampling.

#### 3.2.1 Coating Sample Collection

Provide a sample collection kit as required in paragraph COATING SAMPLE COLLECTION AND SHIPPING KIT. From each lot, obtain a one quart sample of each base material, and proportional samples of each activator based on mix ratio, by random selection from sealed containers in accordance with ASTM D3925. Prior to sampling, mix contents of each sealed container to ensure uniformity. As an alternative to collecting small samples from kits, entire kits may be randomly selected and shipped to laboratory, observing all requirements for witnessing and traceability. For purposes of quality conformance inspection, a lot is defined as that quantity of materials from a single, uniform batch produced and offered for delivery at one time. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Identify samples by designated name, specification number, batch number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph COATING SAMPLE TEST REPORTS.

#### 3.2.2 Abrasive Sample Collection

Provide a sample collection kit as required in paragraph ABRASIVE SAMPLE COLLECTION AND SHIPPING KIT. For purposes of quality conformance inspection, a lot shall consist of all abrasive materials of the same type from a single, uniform batch produced and offered for delivery at one time. Obtain samples of each abrasive lot using the sampling techniques and schedule of MIL-A-22262. The addition of any substance to a batch shall constitute a new lot. Identify samples by designated name, specification number, lot number, project contract number, sample date, intended use, and quantity involved. The QC manager will take possession of the packaged samples, contact the shipping company to arrange for pickup, and relinquish the samples only to the shipping representative for shipment to the approved laboratory for testing as required by the paragraph ABRASIVE SAMPLE TEST REPORTS.

#### 3.2.3 Coating Sample Test Reports

Submit test results for each lot of coating material delivered to the jobsite. Test samples of primer, intermediate, and topcoat materials for compliance with requirements of Table I. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

#### 3.2.4 Abrasive Sample Test Reports

Submit test results for each lot of abrasive delivered to the jobsite. Test samples of metallic abrasive to the requirements of paragraph REQUIREMENTS of SSPC AB 3, except paragraph 4.1.5 DURABILITY. Test samples of non-metallic abrasive as required in paragraph QUALITY CONFORMANCE INSPECTION of MIL-A-22262. Reject entire lot represented by samples that fail one or more tests, select new lots, and test samples.

### 3.3 SURFACES TO BE COATED

Coat exterior surfaces of [tank ] [structure ] [\_\_\_\_\_] [including steel roof, shell, legs, stair, railing, and other exterior appurtenances].

### 3.4 LIGHTING

Provide lighting for all work areas as prescribed in [SSPC Guide 12](#).

### 3.5 ENVIRONMENTAL CONDITIONS

#### 3.5.1 Containment

Design and provide a containment system for the capture, containment, collection, storage and disposal of the waste materials generated by the work under this Section, to meet the requirements of [SSPC Guide 6](#), Class [1][2][3]. Vapor concentrations shall be kept at or below 10 percent of Lower Explosive Limit (LEL) at all times. Containment may be designed as fixed containment for complete structure or portable containment for sections of structure, however, containment shall remain in any one place from beginning of abrasive blasting through initial cure of coating. Waste materials covered by this paragraph shall not include any material or residue from removal of coatings containing lead, chromium, cadmium, PCB, or any other hazardous material.

It is the Contractors responsibility to insure the feasibility and workability of the containment system. The Contractor shall perform his operations and work schedule in a manner as to minimize leakage of the containment system. The containment system shall be properly maintained and shall not deviate from the approved drawings. If the containment system fails to function satisfactorily, the Contractor shall suspend all operations, except those required to minimize adverse impact on the environment or government property. Operations shall not resume until modifications have been made to correct the cause of the failure.

#### 3.5.2 Automated Monitoring Requirements

Provide continuous monitoring of temperature, relative humidity, and dew point data at pertinent points on the structure, during surface preparation, coating application, and initial cure. Locate sensors to provide pertinent data for the surface preparation and coat application being performed. Monitor any heating, cooling, or dehumidification equipment used. Make data available to the Contracting Officer through Internet access. Provide monitoring equipment to perform as follows:

- a. Data is collected in the field unit in one minute increments, and available for download (on-site) in a standard format. Contractor shall collect this data and make available to the Contracting Officer;
- b. Monitoring equipment shall have backup power such that data collection and transmission to web server will be uninterrupted during the entire period of the dehumidification requirement;
- c. Monitoring equipment shall have capability to measure surface temperatures at a minimum of four locations anywhere on a 150 foot diameter by 50 foot high tank;
- d. Monitoring equipment shall have capability to measure interior and

exterior dry bulb temperature (DB), relative humidity (RH), and dewpoint temperature (DP);

- e. Data shall be available continuously through secure Internet connection, using widely available web browsers;
- f. Internet accessible data shall be collected and stored in maximum 15 minute increments, and lag time between data collection and online availability shall be no greater than 70 minutes;
- g. Internet accessible data shall be available for viewing online in tabular format, and graphical format using selected data;
- h. Internet accessible data shall be available for download in user-defined segments, or entire project to date, in a standard format usable by Microsoft Excel and other spreadsheet programs.
- i. Internet-based controls shall provide alerts to pre-designated parties through email messaging;
- j. Internet-based controls shall monitor data uploads from field unit and issue alert if data not initiated within 60 minutes of last upload;
- k. Internet-based controls shall monitor operation of DH equipment and issues alert when power remains off for more than 15 seconds, or if pre-determined temperature, RH, or DP conditions are exceeded;

The requirements listed here were developed around the Munters Exactaire Monitoring System, as this was the only monitoring system having Internet connectivity known to be commercially available. There is no requirement for connectivity of the monitoring system to control the DH equipment, therefore, any combination of equipment having the required functionality will be accepted.

### 3.6 SURFACE PREPARATION

#### 3.6.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case less often than every five operating hours.

#### 3.6.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required by the appropriate abrasive specification daily at startup and every five operating hours thereafter.

#### 3.6.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more one foot square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D7127. When the surface standard complies with all specified

requirements, seal with a clearcoat protectant. Use the surface standard for comparison to abrasive blasted surfaces throughout the course of work.

#### 3.6.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

##### 3.6.4.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean [using a water based pH neutral degreaser ]in accordance with [SSPC SP 1](#), and recheck for contamination until surfaces are free of oil and grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

##### 3.6.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

#### 3.6.5 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with [SSPC SP 10/NACE No. 2](#). Prepared surfaces shall conform to [SSPC VIS 1](#) and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with [ASTM D7127](#), using Rmax as the measure of profile height. Record all measurements required in this standard. Measure profile at rate of three test areas for the first 1000 square feet plus one test area for each additional 1000 square feet or part

thereof. When surfaces are reblasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Do not attempt to wipe surface clean.

### 3.6.6 Disposal of Used Abrasive

Dispose of used abrasive off Government property in accordance with Federal, State, and Local mandated regulations.

### 3.6.7 Pre-Application Testing For Surface Contamination

#### 3.6.7.1 Pre-Application Testing for Oil and Grease Contamination

Ensure surfaces are free of contamination as described in paragraph PRE-PREPARATION TESTING FOR OIL AND GREASE CONTAMINATION, except that only questionable areas need be checked for beading of water misted onto surface.

#### 3.6.7.2 Pre-Application Testing for Soluble Salts Contamination

Test surfaces for chloride contamination using the Test Kit described in TEST KIT FOR MEASURING CHLORIDE, SULFATE AND NITRATE IONS ON STEEL AND COATED SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. [Concentrate testing of bare steel at areas of coating failure to bare steel and areas of corrosion pitting. ] [Perform 30 percent of tests on bare steel at welds, divided equally between horizontal and vertical welds. ] One or more readings greater than 3 micrograms per square centimeter of chlorides or 10 micrograms per square centimeter of sulfates or 5 micrograms per square centimeter of nitrates is evidence of soluble salt contamination. Reject contaminated surfaces, wash as discussed in paragraph PRE-PREPARATION TESTING FOR SOLUBLE SALTS CONTAMINATION, allow to dry, and re-test until all required tests show allowable results. Reblast tested and cleaned areas as required. Label all test tubes and retain for test verification.

#### 3.6.7.3 Pre-Application Testing for Surface Cleanliness

Apply coatings to dust free surfaces. To test surfaces, apply strip of clear adhesive tape to surface and rub onto surface with finger. When removed, the tape should show little or no dust, blast abrasive, or other contaminant. Reject contaminated surfaces and retest. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof. Provide two additional tests for each failed test or questionable test. Attach test tapes to Daily Inspection Reports.

### 3.7 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

#### 3.7.1 Preparation of Sealant and Coating Materials for Application

Each of the sealant, primer, intermediate, and topcoat materials is a two-component material supplied in separate containers.

##### 3.7.1.1 Mixing Sealant, Primer and Intermediate Coat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time



based on its temperature.

### 3.7.1.2 Mixing Topcoat Material

Do not mix partial kits, or alter mix ratios. Mix polyurethane coating materials in same temperature conditions specified in paragraph DELIVERY AND STORAGE. The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life. Use a mixer that does not create a vortex. Do not add solvent without specific written recommendation from the manufacturer. No induction time is required, only thorough agitation of the mixed material.

### 3.7.1.3 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Add all required solvent at time of mixing. Do not add solvent to extend pot life. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. Precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy primer and intermediate materials	4 hours
Polyurethane topcoat materials	2 hours.

### 3.7.1.4 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of sealant, primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature between 60 and 100 degrees F during application and the first four hours of cure for epoxy coats and the first eight hours of cure for polyurethane coats. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coat during appropriate RECOAT WINDOW of preceding coat. If a RECOAT WINDOW is missed, the minimum and maximum primer and intermediate coat thickness may be adjusted to accommodate a FILL COAT, however, requirements for total epoxy coating thickness and total coating thickness will not be modified. Missing more

than one RECOAT WINDOW may require complete removal of coating if maximum total coating thickness requirements cannot be achieved.

If coating is not applied during RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, provide GLOSS REMOVAL, apply next coat within 24 hours. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as noncompliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT.

RECOAT WINDOWS						
<u>EPOXY OVER EPOXY</u>						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
<u>POLYURETHANE OVER EPOXY</u>						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
<u>POLYURETHANE OVER POLYURETHANE</u>						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2

The temperature ranges shown in the table above are for determining recoat

windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 2 to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.

GLOSS REMOVAL - Where required, hand sand in a linear fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer coat is to scarify surface and shall consist of removal of approximately 1 mil of coating. If steel is exposed during GLOSS REMOVAL, repair in accordance with paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of intermediate coat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

### 3.7.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of roof joint sealant, epoxy coat, or polyurethane topcoat for amine blush contamination using the Test Kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Remove any identified contamination using an approved procedure.

### 3.7.3 Application of Coating System and Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION, as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. For convenience, stripe coat material may be delivered by spray if followed immediately with brush-out and approved procedures include appropriate controls on

thickness. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond [ 15] [\_\_\_\_\_] feet from the structure perimeter] [the tank berm]. Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

Apply coatings at the following specified thickness:

Coat	Minimum DFT (Mils)	Maximum DFT (Mils)
Primer	3	5
Intermediate	3	5
Top	2	3
Total system	8	13

#### 3.7.3.1 Application of Primer

Apply primer coat, maintaining paint supply container height within 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

#### 3.7.3.2 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

#### 3.7.3.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

#### 3.7.3.4 Non-skid for Stairs and Top

Where non-skid is required, apply a second intermediate coat, and immediately follow with application of non-skid grit, broadcast at the rate of 2 pounds per 100 square feet, and backroll. Apply topcoat as specified.

#### 3.7.3.5 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

#### 3.7.3.6 Application of Joint Sealant

Apply joint sealant to back-to-back steel joints that are less than 3/8 inches wide and are not seal welded. Apply sealant to top and bottom, or each side, of narrow joints. Apply sealant within 48 hours of application of the topcoat, and touch-up with topcoat after appropriate cure of the sealant.

### 3.7.3.7 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with **SSPC SP 10/NACE No. 2**, and feather coating as required to leave **4 inches** of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional **4 inches** beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceding coat. Within four hours of preparation, apply zinc-rich primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

### 3.7.3.8 Structure Occupancy After Coating Application

Use clean canvas or other approved shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

## 3.8 PROJECT IDENTIFICATION

At the completion of the work, stencil the following information on the [structure] [tank exterior adjacent to the main manway opening] in 3/4 to one inch Helvetica style letters of contrasting color using acrylic stencil paint:

Date exterior coated:

Project Number:

Contractor:

Address:

Coating System

Surface Prep: **SSPC SP** \_\_\_\_\_ Profile: \_\_\_\_\_

Primer: \_\_\_\_\_ Thickness: \_\_\_\_\_

Intermediate: \_\_\_\_\_ Thickness: \_\_\_\_\_

Topcoat: \_\_\_\_\_ Thickness: \_\_\_\_\_

Total Thickness: \_\_\_\_\_

## 3.9 FIELD QUALITY CONTROL

For marking of tank surfaces, use chalk for marking bare steel, and water based markers for marking coated surfaces, and remove marks prior to coating. Do not use any wax or grease based markers, or any other markers that leave a residue or stain.

### 3.9.1 Coating Inspector

The coating inspector shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section **01 45 00.00 10 01 45 00.00 20 01 45 00.00 40** QUALITY CONTROL. The Coating Inspector shall be present

during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities as specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting requirements specified in Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL.

### 3.9.2 Field Inspection

#### 3.9.2.1 Inspection Requirements

Perform field inspection in accordance with ASTM D3276 and the approved Coating Work Plan. Document Contractor's compliance with the approved Coating Work Plan.

Provide all tools and instruments required to perform the required testing, as well as any tools or instruments that the inspector considers necessary to perform the required inspections and tests. Document each inspection and test, including required hold points and other required inspections and tests, as well as those inspections and tests deemed prudent from on-site evaluation to document a particular process or condition, as follows:

- a. Location or area;
- b. Purpose (required or special);
- c. Method;
- d. Criteria for evaluation;
- e. Results;
- f. Determination of compliance;
- g. List of required rework;
- h. Observations.

Collect and record Environmental Conditions as described in ASTM D3276 on a 24 hour basis, as follows:

- a. During surface preparation, every two hours or when changes occur;
- b. During coating application and the first four days of initial cure, every hour, or when changes occur;
- c. Note location, time, and temperature of the highest and lowest surface temperatures each day;
- d. Use a non-contact thermometer to locate temperature extremes, then verify with contact thermometers.

Document all equipment used in inspections and testing, including manufacturer, model number, serial number, last calibration date and future calibration date, and results of on-site calibration performed.

Document Contractors compliance with the approved Coating Work Plan.

#### 3.9.2.2 Inspection Report Forms

Develop project-specific report forms as required to report measurements, test results, and observations being complete and conforming to

contract requirements. This includes all direct requirements of the contract documents and indirect requirements of referenced documents. Show acceptance criteria with each requirement and indication of conformity of each inspected item. The data may be in any format, but must be legible and presented so that entered data can be quickly compared to the appropriate requirement.

#### 3.9.2.3 Daily Inspection Reports

Submit one copy of daily inspection report completed each day when performing work under this Section, to the Contracting Officer. Note all non-compliance issues, and all issues that were reported for rework in accordance with QC procedures of Section 01 45 00.00 10 01 45 00.00 20 01 45 00.00 40 QUALITY CONTROL. Each report shall be signed by the coating inspector and the QC Manager. Submit report within 24 hours of date recorded on the report.

#### 3.9.2.4 Inspection Logbook

A continuous record of all activity related to this Section shall be maintained in an Inspection Logbook on a daily basis. The logbook shall be hard or spiral bound with consecutively numbered pages, and shall be used to record all information provided in the Daily Inspection Reports, as well as other pertinent observations and information. The Coating Inspector's Logbook that is sold by NACE is satisfactory. Submit the original Inspection Logbook to the Contracting Officer upon completion of the project and prior to final payment.

#### 3.9.2.5 Inspection Equipment

All equipment shall be in good condition, operational within its design range, and calibrated as required by the specified standard for use of each device.

### 3.10 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ia - Zinc-rich Epoxy Primer Coat <a href="#">MIL-DTL-24441/19</a> Formula 159						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent (zinc dust)	---	---	81.5	85.5	---	---
Volatiles, percent	42.8	44.3	8.0	8.4	---	---
Non-volatile vehicle percent	53.7	57.7	8.3	8.7	---	---
Weight, Kilograms/liter	0.87	1.01	3.30	3.40	2.80	2.91
Weight, Pounds/gallon	7.3	8.4	27.5	28.4	23.4	24.4
Flashpoint, Degrees C	35.6	---	37.8	---	---	---
Flashpoint, Degrees F	96	---	100	---	---	---
Consistency, grams	---	---	250	500	150	300
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	2
Dry hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Sag resistance, Mils	---	---	---	---	12	---
VOC, Grams/liter	---	---	---	---	---	304
VOC, Pounds/gallon	---	---	---	---	---	2.5
NOTES: Test methods as specified in <a href="#">MIL-DTL-24441</a> .						



TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ib. - Epoxy Intermediate Coat <u>MIL-DTL-24441/31</u> Formula 152 Type IV (White (Tinted))						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Pigment content, percent	44.0	49.0	33.0	38.0	---	---
Volatiles, percent	29.0	35.0	16.0	21.0	---	---
Non-volatile vehicle percent	17.5	23.5	44.0	49.0	---	---
Coarse particles, percent	---	0.3	---	0.3	---	---
Consistency, grams	180	320	300	470	180	245
Weight, Kilograms/liter	1.39	1.45	1.29	1.35	1.34	1.4
Weight, Pounds/gallon	11.6	12.1	10.8	11.3	11.2	11.7
Set to touch time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	3
Dry hard time, hours at 23 degrees C, 73 degrees F	---	---	---	---	---	8
Fineness of grind, Hegman	4	---	4	---	---	---
Flashpoint, Degrees C	35.5	---	37.8	---	---	---
Flashpoint, Degrees F	96	---	100	---	---	---
Titanium dioxide, percent of pigment	91	---	---	---	---	---
Pot life, hours at 23 degrees C, 73 degrees F	---	---	---	---	4	---
Sag resistance, Micrometers	---	---	---	---	300	---
Sag resistance, Mils	---	---	---	---	12	---

TABLE 1						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ib. - Epoxy Intermediate Coat <u>MIL-DTL-24441/31</u> Formula 152 Type IV (White (Tinted))						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Color of dry film to approximate color of <u>SAE AMS-STD-595A</u> color 27778	---	---	---	---	---	Conform
Contrast ratio, at 75 micrometers, 3 mils DFT	---	---	---	---	.098	---
Gloss, 60 degree specular	---	---	---	---	35	---
VOC, Grams/liter	---	---	---	---	---	340
VOC, Pounds/gallon	---	---	---	---	---	2.8
GENERAL NOTES: Test methods as specified in <u>MIL-DTL-24441</u> . Where "Conform" is indicated, refer to specific requirements of <u>MIL-DTL-24441/31</u> .						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic - Polyurethane Topcoat <u>MIL-PRF-85285</u> Type II (White and Colors)						
<u>Test</u>	<u>Component A</u>		<u>Component B</u>		<u>Mixed</u>	
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>
Moisture content, percent	---	2	---	---	---	---
Course particles, percent	---	---	---	---	---	.5
Viscosity	---	---	---	---	---	See Note 1
Fineness of grind, Hegman	---	---	---	---	7	---

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic - Polyurethane Topcoat <u>MIL-PRF-85285</u> Type II (White and Colors)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Drying to touch (See Note 2)	---	---	---	---	---	4
Dry-hard (See Note 2)	---	---	---	---	---	8
VOC, grams per liter	---	---	---	---	---	340
Color	---	---	---	---	delta E+-1.0	
Gloss 60 degree specular gloss						
Gloss	---	---	---	---	---	90
Semi-gloss	---	---	---	---	15	45
Opacity	---	---	---	---	0.95	---
Flexibility	---	---	---	---	---	Conform
Fluid resistance	---	---	---	---	---	Conform
Heat resistance (cure)	---	---	---	---	---	Conform
Solvent resistance (cure)	---	---	---	---	---	Conform
Condition in container	---	---	---	---	---	Conform
Odor	---	---	---	---	---	Conform
Lead percent	---	---	---	---	---	0.06
Cadmium percent	---	---	---	---	---	0.06
Chromium percent	---	---	---	---	---	0.00
NOTES:						
(1) Modify paragraph 3.6.4 Viscosity and Pot Life, of <u>MIL-PRF-85285</u> as follows:						
The viscosity of the admixed coating, when tested in accordance with <u>ASTM D1200</u> through a No. 4 Ford cup, shall be as follows:						

TABLE I						
COATING QUALITY CONFORMANCE INSPECTION REQUIREMENTS						
Table Ic - Polyurethane Topcoat <u>MIL-PRF-85285</u> Type II (White and Colors)						
Test	Component A		Component B		Mixed	
	Min.	Max.	Min.	Max.	Min.	Max.
Time from mix (minimum)			Maximum time through a No. 4 Ford Cup			
Initially			30 seconds			
2 hours			60 seconds			
4 hours			No gel			
(2) Modify paragraph 3.7.1 Drying Time, of <u>MIL-PRF-85285</u> . When applied by spray techniques and when tested in accordance with <u>ASTM D1640/D1640M</u> , the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).						
GENERAL NOTES: Test methods as specified in <u>MIL-PRF-85285</u> , except those marked with "*". Where "Conform" is indicated, refer to specific requirements of <u>MIL-PRF-85285</u> .						

-- End of Section --

## SECTION 09 97 13.28

PROTECTION OF BURIED STEEL PIPING AND STEEL BULKHEAD TIE RODS  
02/10

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA C209 (2019) Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipelines
- AWWA C213 (2022) Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
- AWWA C214 (2020) Tape Coating Systems for the Exterior of Steel Water Pipelines
- AWWA C215 (2016) Extruded Polyolefin Coatings for Steel Water Pipe

## NACE INTERNATIONAL (NACE)

- NACE SP0274 (1974; R 2011) High Voltage Electrical Inspection of Pipeline Coatings

## U.S. DEPARTMENT OF DEFENSE (DOD)

- MIL-I-631 (1961; Rev D; Am 6 1987; Notice 1 2021) Insulation, Electrical, Synthetic-Resin Composition, Nonrigid

## 1.2 DEFINITIONS

## 1.2.1 Coating

A continuous, uniformly thick layer formed on a surface by the mechanical application of a liquid, mastic, powdered, or extruded film material. Some types of application require elevated temperatures.

## 1.2.2 Coating System

One or more coatings applied to a properly prepared steel surface. If only one coating, that coating is applied directly to the steel surface; if more than one coating, each coating is applied in one operation over the previously applied and cured coating. For some applications, the first coating is a primer. Coatings of a particular system function together as a collective entity to protect the steel surface from corrosion. Coating system may be either liquid or tape applied.

## 1.2.3 Tape

Prefabricated laminate of plastic film backing with a homogeneous sealant layer or a pressure-sensitive adhesive layer produced in sheets, pads, or rolls wound on hollow cores. Tape applications do not require elevated temperatures.

#### 1.2.4 Tape Coating System

One or more layers of tape applied cold over a properly prepared and primed steel surface. Tape on the primed surface protects the steel surface from corrosion.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Factory-applied Coating System

Field-applied Epoxy Coating system

Thermosetting epoxy coating system

Polyethylene-Butyl Adhesive Coating System

Adhesive Thermoplastic Resin Coating System

Tape Coating System

Electrical-flaw Detector

[ Mastics

] [ Rock Shield]

[ SD-06 Test Reports

Inspector's Certificate

Submit for each inspection and test.

Field-applied Epoxy Coating

] SD-08 Manufacturer's Instructions

Field-applied Epoxy Coating system

Thermosetting Epoxy Coating System

Electrical-flaw Detector

[ Mastics

] [ Rock Shield

] PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Tape Coating System (TCS)

Prefabricated tape with adhesive primer [for bulkhead tie rods and turnbuckles] [ and ] [for use on [pipe, ]couplings, damaged areas and fittings]. The tape wrapping system shall conform to AWWA C209 and to MIL-I-631, Class I for fungus resistance, except that the fungus rating shall lie between zero and one for all specimens. The overall thickness of the tape wrap protection shall be not less than [30] [45] [\_\_\_\_\_] mils. [ The tape system shall be suitable to be applied at temperatures below 50 degrees F and above 10 degrees F.]

2.1.2 Adhesive Thermoplastic Resin Coating System (ATRCs)

Steel pipe factory-applied coating system conforming to AWWA C215 and coating manufacturer's instructions shall consist of a continuously extruded polyethylene coating[, capable of withstanding operating temperatures up to 190 degrees F,] applied on an adhesive undercoat.

2.1.3 Thermosetting Epoxy Coating System (TECS)

Factory-applied steel pipe system conforming to AWWA C213. Provide field-applied epoxy coating in accordance with manufacturer's recommendations and AWWA C213.

2.1.4 Polyethylene-Butyl Adhesive Coating System (PBACS)

Factory-applied steel pipe system of extruded butyl adhesive compound, 7 mils minimum thickness, covered with overlapping layers of extruded polyethylene wrapping, 38 mils minimum thickness, in accordance with AWWA C214.

[2.1.5 Mastics

Apply a coating of manufacturer approved mastic protection to irregular surfaces. Mastic shall be compatible with coating system. [ Apply the tape system over mastic.] Mastic layer thickness shall conform to coating manufacturer's recommendation.

] [2.1.6 Rock Shield

Provide rock shield over completed coating system as recommended by coating manufacturer.

] PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 TCS

3.1.1.1 Surface Preparation

Surfaces shall be clean and dry. Wire brush weld beads, and remove weld spatters. Remove heavy rust or mill scale with wire brush.

### 3.1.1.2 Application

Remove paper from Kraft paper-protected material before placing in final position. Reinforce coating at sling points with roofing felt or other approved heavy shielding material, or handle with nylon or canvas slings. Apply polyvinylchloride-butyl rubber laminated tape or pressure-sensitive organic plastic tape and its adhesive primer by single machine operation.

- a. Pipe: Spirally wrap straight runs in one layer, lapping the tape as applied. Overlap shall conform to recommendations of the tape manufacturer. When an outerwrap is used, overlap of outerwrap shall bridge joints of the tape. Apply at each end of straight runs a double wrap of one full width of tape at right angles to the axis in such a manner so as to seal ends of spiral wrapping.
- b. Pipe Joints and Couplings and Damaged Areas of Coatings: Clean joint areas which are to be taped, of burrs and rust. Smooth down or cut away damaged coating when not firmly bonded to pipe. Spirally wrap with a two-layer wrapping system, overlapping coating surface at least **3 inches**. Initially stretch tape sufficiently to conform to the surface to which it is applied, using one layer half-lapped for tape **2 inches** or less in width or one layer lapped at least **one inch** for tape more than **2 inches** wide. Apply a second layer, lapped as above, with tension as tape comes off roll, and press to conform to shape of component. For other irregular surfaces such as bolted flanges valve bodies where tape coating system containing mastics is to be provided, apply with brush.
- c. Tie Rods and Tie Rod Fittings: Spirally wrap with a two-layer coating system. Apply tape to tie rods by lapping each layer of tape using a half-lap for tape **2 inches** or less in width or at least a **one inch** lap for tape more than **2 inches** wide. For tie rod fittings, initially stretch tape sufficiently to conform to the surface to which it is applied, using one layer half-lapped for tape **2 inches** or less in width or one layer lapped at least **one inch** for tape more than **2 inches** wide. Apply a second layer, lapped as before, with a tension as tape comes off the roll, and press to conform to the shape of component.

### 3.1.2 Joints, and Other Irregular Surfaces For ATRCS

Prepare surface as described in paragraph entitled "TCS." Wrap tape as specified in paragraph entitled "TCS"; except, apply the tape half-lapped, and prime extruded polyethylene coating and adhesive undercoat surfaces to be tape wrapped with a compatible primer as recommended by the tape manufacturer and approved by the extruded polyethylene coating applicator for use on the polyethylene coating.

#### 3.1.2.1 Damaged Areas

Repair damaged areas of the extruded polyethylene coating by tape wrapping as specified under the paragraph, entitled "Tape Coating System" except press residual material from the extruded polyethylene coating into the break, or trim off. Prime areas to be taped prior to applying half-lapped tape.

#### 3.1.3 TECS

Install in accordance with the manufacturer's instructions and **AWWA C213**.



### 3.1.3.1 Joints

Clean both sides of weld area by wire brushing, and remove dust, moisture, and other contaminants. Apply primer recommended by coating manufacturer after cleaning of joints.

### 3.1.3.2 Damaged Areas

Remove damaged coating by abrading, filing, or wire brushing. Clean area to be repaired free of dust, moisture, and other contaminants. Cover with a primer and a coating recommended by coating manufacturer. Apply coating over cleaned surface, and extend approximately 3 inches beyond damaged area.

### 3.1.4 Joints and Other Irregular Surfaces For PBACS

Clean both sides of weld area by wire brushing, and remove dust, moisture, and other contaminants. Apply primer recommended by tape manufacturer and acceptable to coating manufacturer on cleaned area. Apply tape spirally with a 50-percent overlap in accordance with the tape manufacturer's instructions.

#### 3.1.4.1 Damaged Areas

Remove rough or protruding polyethylene from damaged area by abrading, filing, or cutting the material. Clean area to be repaired free of dust, moisture, and other contaminants. Cover with tape recommended by coating manufacturer and primer recommended by tape manufacturer. Apply primer over cleaned surface, and extend approximately 3 inches beyond damaged area. Apply tape over primer, and extend one inch beyond damaged area. Apply additional primer over tape patch. Spirally wrap additional tape around pipe with a 50-percent overlap to cover tape patch, and extend a minimum of 2 inches beyond the edge of the patch.

## 3.2 FIELD QUALITY CONTROL

Conform to AWWA C214 [ and AWWA C213 ]. [ Inspection shall be performed by a National Association of Corrosion Engineers (NACE) certified inspector.]

### 3.2.1 Field Inspection

Examine material surface preparation and application procedures performed in the field.

### 3.2.2 Field Test

Test the protective system for holes, voids, cracks, and other visually undetectable damage that may occur during handling and installation in accordance with NACE Standard NACE SP0274. In critical applications no holidays will be permitted. In non critical applications up to 3 holidays per linear feet of the pipe may be accepted. Test with an approved electrical-flaw detector in accordance with the detector manufacturer's printed instructions. Prepare inspector's certificate for each inspection and test. Repair areas where arcing occurs and retest.

-- End of Section --

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## SECTION 09 97 23

## METALLIC TYPE CONDUCTIVE/SPARK RESISTANT CONCRETE FLOOR FINISH

08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117 (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary

ACI 302.1R (2015) Guide for Concrete Floor and Slab Construction

## ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M (2018) Standard Specification for Concrete Aggregates

ASTM C94/C94M (2021b) Standard Specification for Ready-Mixed Concrete

ASTM C150/C150M (2021) Standard Specification for Portland Cement

ASTM C494/C494M (2019) Standard Specification for Chemical Admixtures for Concrete

ASTM C1602/C1602M (2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete

ASTM E1155 (2020) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers

ASTM F150 (2006; R 2013) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Graded Iron

Curing Compound

Water Reducing Admixture

High Range Water Reducing Admixture

#### SD-04 Samples

Conductive and Spark-Resistant Floor Finish

#### SD-05 Design Data

Mix Design

#### SD-06 Test Reports

Cement

Aggregate

Admixtures

Conductivity and Spark Resistance

Water

#### SD-08 Manufacturer's Instructions

Metallic Surfacing

Curing of Floor Finish

#### SD-10 Operation and Maintenance Data

Conductive Spark-Resistant Floor Finish, Data Package 1; G[,  
[\_\_\_\_\_]]

### 1.3 PERFORMANCE REQUIREMENTS

#### 1.3.1 Conductivity

Floor finish must have a [minimum electrical resistance of [5,000] [10,000] [20,000] ohms and a] maximum average electrical resistance of 1,000,000 ohms. Measure electrical resistances on conditioned sample slab and on conditioned project slab using method of test specified herein.

#### 1.3.2 Spark Resistance

Floor finish must produce no spark when tested using method of test specified herein.

### 1.4 ENVIRONMENTAL CONDITIONS

Do not start work unless environmental conditions conform to manufacturer's printed instructions. Maintain recommended environmental conditions without interruption during application and curing processes.

### 1.5 MANUFACTURER'S REPRESENTATIVE

Have manufacturer's technical representative present during start-up of each phase of work including inspection of grounding materials, preparation of base slab, mixing and placing concrete topping, application of dusted-on metallic surfacing, curing and testing.

### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver manufactured materials in manufacturer's original unbroken packages or containers plainly labeled with manufacturer's names, brands, lot numbers, and product expiration date. Use moisture-resistant containers. Store materials in dry, weathertight enclosures and handle in a manner that will prevent inclusion of foreign materials or damage by dampness.

### 1.7 CONDUCTIVE AND SPARK-RESISTANT FLOOR FINISH SAMPLE

Before work is started, prepare, test, and submit sample of conductive and spark-resistant floor finish, 4 feet square and [2] [\_\_\_\_\_] inches thick. Cast sample on 1/2 inch thick plywood base covered with polyethylene film. Mix and apply topping in accordance with this specification, including troweling, curing, and protection.

Test floor finish sample for compliance with the conductivity and spark resistance requirements specified herein. Perform testing using an approved independent testing laboratory.

## PART 2 PRODUCTS

### 2.1 FLOOR FINISH MATERIALS

#### 2.1.1 Portland Cement

ASTM C150/C150M, Type I [or II]. Submit test report showing compliance with ASTM C150/C150M.

#### 2.1.2 Aggregate

ASTM C33/C33M, except as specified below. Provide pea gravel, silica, traprock, or other approved materials of equivalent hardness. Conform to the following gradation:

<u>Mesh</u>	<u>Percent Passing</u>
3/8 inch	100
No. 4	95-100
No. 8	65-80
No. 16	45-65
No. 30	25-45
No. 50	5-15

<u>Mesh</u>	<u>Percent Passing</u>
No. 100	0-5

Submit test report showing compliance with [ASTM C33/C33M](#).

### 2.1.3 Admixtures

[ASTM C494/C494M](#). Water reducing, normal setting (Type A); [water reducing admixture](#) (Type D); or [high range water reducing admixture](#) (Type F). Admixtures must not contain more than 0.05 percent chloride ions. Submit product data for water reducing admixture and high range water reducing admixtures. Submit test report showing compliance with [ASTM C494/C494M](#).

### 2.1.4 Water

Provide water complying with the requirements of [ASTM C1602/C1602M](#). Provide [potable ]water for mixing, free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with [ASTM C1602/C1602M](#).

## 2.2 GROUNDING MATERIALS

### 2.2.1 Ground Rods

[Hard copper] [Copper-clad steel] [Brass] [Stainless steel] not less than [0.75 inch](#) in diameter, [10 feet](#) long. Die stamp each ground rod near top with name or trademark of manufacturer and length of rod in [feet](#).

### 2.2.2 Grounding Studs

Hard copper, or brass, [1/2 inch](#) diameter and of such length as to project into structural concrete base slab not less than [3 inches](#) when installed.

### 2.2.3 Grounding Connector Disks

Approximately [2 to 4 inch](#) diameter or [2 to 4 inch](#) square pieces of copper or brass hardware cloth, 4 mesh, [0.047 inch](#) wire diameter.

## 2.3 METALLIC SURFACING MATERIAL

### 2.3.1 Graded Iron Mixture

A factory-prepared dry mixture of graded iron particles, cement, and chemicals; suitable for application by the dusted-on method; and free from nonferrous metal particles, oils, grease, soluble alkaline compounds, rust and materials intended to disguise rust, and any other contaminants. Submit product data for [graded iron](#) mixture.

Submit [conductive spark-resistant floor finish](#), Data Package 1, in accordance with Section [01 78 23](#) OPERATION AND MAINTENANCE DATA.

### 2.3.2 Water Content

Provide water absorbent metallic aggregate containing not more than 0.075 percent water soluble materials.

### 2.3.3 Cement Dispersing Agent

Combine a cement-dispersing agent, a pozzolanic material capable of combining with free lime to form a water insoluble compound, and an approved binder with metallic aggregate.

#### 2.3.4 Purity

Do not add material to factory-prepared product at job site.

#### 2.4 CURING COMPOUND

A product of the manufacturer of the metallic surfacing material or a type recommended by the manufacturer of the metallic surfacing material. Submit product data for curing compound.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF GROUNDING MATERIALS

Provide at least one ground [rod] [or] [stud] for each 400 square feet or less of floor area. Place grounding materials at least 2 inches clear and free of pipes, conduits, sleeves, anchor bolts, floor drains, or other metal building material that projects through floor finish. Place tops of [rods] or [studs] at an elevation not more than 3/8 inch below top surface of finish floor. Do not allow [rods] or [studs] to project above finish floor elevation. Center grounding connector disks on top of [rods] [or] [studs]. Braze disks to tops of [rods] [or] [studs]. Connect each ground [rod] [or] [stud] electrically to concrete slab reinforcement steel. Connect using a copper or brass braided strap. Braze to both reinforcing steel and ground [rod] [or] [stud].

##### 3.1.1 Ground Rods

Drive ground rods vertically into earth. The maximum resistance to ground of driven ground rod must not exceed 25 ohms when tested in accordance with paragraph GROUNDING TESTS.

##### 3.1.2 Ground Studs

Connect studs together electrically using a continuous No. 6 AWG copper wire brazed to each stud and to a common ground wire connected electrically to an approved ground. Place stud interconnecting wire on, shape, and fasten to existing concrete base slab to prevent wire from lifting when concrete topping is placed.

#### 3.2 PREPARATION OF BASE SLAB

##### 3.2.1 Cleaning

Wash dirt and debris from surface of base slab.

Remove dirt, oil, grease, laitance or other foreign matter from surface of base slab. Scrub surface and rinse thoroughly with clean water. Keep base slab wet for a period of not less than 12 hours preceding application of topping.

Remove dirt, oil, grease, laitance or other foreign matter from surface of base slab. Scrub surface with a 10 percent muriatic acid solution and rinse thoroughly with clean water. After rinsing, a litmus test of the wet

surface must indicate no trace of acid solution.

### 3.2.2 Bond Coat

Remove excess water or dry slab until there is no free water. Apply a cement paste, latex, latex cement, or epoxy bond coat.

## 3.3 PROPORTIONING AND MIXING OF CONCRETE TOPPING

### 3.3.1 Proportioning

[Proportion concrete topping mix to provide a 28-day compressive strength of 5,000 psi, with a maximum slump of 3 inches or less. If high range water reducing admixture is used, slump may be increased to 8 inches.] [Proportion concrete topping mixture by volume with one part portland cement and 2 3/4 parts 3/8 inch maximum size aggregate. Use a maximum water-cement ratio of 0.45 including moisture contained in aggregates.] Topping mix may be modified, as approved, to conform to requirements of manufacturer of metallic surfacing material. Submit concrete mix design for topping slab.

### 3.3.2 Mixing

Perform mixing in mechanical mixers of a type in which quantities of water can be controlled accurately and uniformly. Introduce and mix aggregates so that materials are distributed uniformly throughout the mass. Add water gradually. After cement, aggregates, and water are in mixer drum, mix for two minutes. Ready-mixed concrete must conform to ASTM C94/C94M. Do not retemper topping mixture with water. Additional dosage with high range water reducing admixture may be permitted with prior approval of the Contracting Officer as to methods and procedures. Use only admixture specified and approved in proposed mix design.

## 3.4 PLACING, FINISHING, AND CURING

### 3.4.1 Placing Concrete Topping

Place, compact and strike-off topping mixture to the full depth of the [2] [ ] inch screed strips. Tamp thoroughly with a grill-faced tamper (do not use a flat-faced tamper) or vibrate with a small vibrator to compact concrete topping, force out entrapped air, and ensure maximum density. Take extreme care in placing and tamping so that grounding system will not be damaged or misaligned. Form a slight cup-shaped pocket or depression, about 3 inches in diameter and 3/4 inch in depth in topping finish surrounding grounding connector disks on tops of [rods] [and] [studs]. Keep disk free of topping mix by protecting disk with a plastic sheet. After compacting, screeding and leveling floor surface, remove excess water by an approved method. Mechanically float surface.

### [3.4.2 Placing and Finishing Base Slab

Where metallic surfacing is to be placed directly upon base slab, place slab in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. Take extreme care in placing and consolidating concrete so that grounding system is not damaged or misaligned. Form a slight cup-shaped pocket or depression, about 3 inches in diameter and 3/4 inch in depth in the finish surrounding grounding connector disks on the tops of the [rods] [and] [studs]. Keep disk free of concrete and mortar by protecting disk with plastic sheet. After placing, consolidating, striking off and leveling, remove excess water by an approved method. Mechanically float the surface.



]3.4.3 **Metallic Surfacing**

Before opening, shake surfacing material containers to ensure uniformity of ingredients. After floating floor surface, dust dry metallic surfacing material uniformly on surface at a rate of not less than **0.9 pound per square foot** of surface. When metallic aggregate has absorbed surface moisture, mechanically float surface. After floating, uniformly dust on surface remaining dry metallic surfacing material to achieve a total rate of not less than **1.8 pound per square foot** of surfacing material for the two dusting operations. Apply second shake at right angles to first for even application. Repeat floating operation. Submit manufacturer's instructions for application of metallic surfacing.

3.4.4 **Finishing**

Finish floor to a smooth surface, free from blemishes. Test floor surface with a straight edge to ensure a tolerance of plus or minus [ **1/4 inch**] [ **1/8 inch**] in **10 feet**.

[ Construct in accordance with one of the methods recommended in **ACI 302.1R**, Table 7.15.3, "Typical Composite Ff/FL Values for Various Construction Methods." **ACI 117** for tolerance tested by **ASTM E1155**.

## a. Specified Conventional Value:

Floor Flatness (Ff) [20] [\_\_\_\_\_] [13] [\_\_\_\_\_] minimum  
 Floor Levelness (FL) [15] [\_\_\_\_\_] [10] [\_\_\_\_\_] minimum

## b. Specified Industrial:

Floor Flatness (Ff) [30] [\_\_\_\_\_] [15] [\_\_\_\_\_] minimum  
 Floor Levelness (FL) [20] [\_\_\_\_\_] [10] [\_\_\_\_\_] minimum

Test slab within 24 hours of the final troweling. Provide tests to Contracting Officer within 12 hours after collecting the data. Floor flatness inspector is required to provide a tolerance report which must include:

## a. Key plan showing location of data collected.

## b. Results required by ASTM E1155.

] Take extreme care so that conductive metallic aggregate contained in surfacing material is in full and firm contact with disks attached to top of grounding [rods] [ and ] [studs]. Do not float or trowel surfaces excessively in a manner that buries metallic aggregate or contaminates surfacing material during floating and trowelling operations. Protect flooring from contamination by subgrade material, tracked or spilled concrete, sand, stone, or other material during finishing operations. Remove flooring contaminated and replace with new flooring. Match approved finish floor sample in all respects.

3.4.5 **Curing** and Protection

Cure and protect floor finish for not less than 30 days unless a longer period is recommended by the manufacturer's printed instructions. Strip floor finish of conductive curing compounds only in those areas where acceptance tests will be performed. Strip non-conductive curing compounds

completely. Submit manufacture's printed instructions for curing the floor finish.

### 3.5 FIELD TESTS

Conduct testing in the presence of the Contracting Officer.

#### 3.5.1 Grounding Tests

Test ground [studs] [ and ] [rods] and interconnecting ground wire before the concrete slab is placed and again before the topping finish is placed. Before final wiring is connected to the ground rods, test each rod or group of rods for ground resistance using a portable ground testing megohmmeter developing an A.C. voltage. Equip the instrument with a meter reading directly in ohms. Use two reference ground rods of 3/4 inch copper clad steel, not less than 4 feet in length, driven 3 1/2 feet deep. Install rods in a straight line from the ground being tested. Connect No. 14 AWG stranded wire leads with at least 600-volt insulation to the ground being tested and the two reference grounds and to proper binding posts on the instrument. Where there is more than one ground within a circle of 10 feet at a particular location, use reference rods as driven for the "first" test for tests on the other rods without changing their location.

#### 3.5.2 Acceptance Tests

Make tests for conductivity and spark resistance of metallic finish after floor finish has been cured and dried for 30 days. Perform at least one test for each 400 square feet or less of floor area for conductivity and for spark resistance. Submit test reports showing compliance with the conductivity and spark test criteria.

##### 3.5.2.1 Conductivity Tests

Conduct conductivity tests of finished floor surface in accordance with ASTM F150. For compliance, the average of maximum resistances must be within the limits specified with no value greater than 5 megohms.

##### 3.5.2.2 Spark Tests

Determine spark resistance of finished floor surfaces in a darkened space by stroking the floor vigorously with a 12 inch metal file in a 6 foot arc. Perform spark test five times in each 400 square feet or less of flooring area. Areas with no visible spark production will be accepted as having necessary spark resistance.

-- End of Section --

## SECTION 09 97 23.16

## LINSEED OIL PROTECTION OF CONCRETE SURFACES

11/10

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

- ASTM C309** (2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM D235** (2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

## 1.2 DELIVERY, STORAGE AND HANDLING

Deliver the [linseed oil-mineral spirit compound] [linseed oil emulsion] in original sealed containers that show the designated name, specification number, batch number, date of manufacture, manufacturer's directions, and name of manufacturer. [Linseed oil-mineral spirits compound has a flash point of about 100 degrees F and is readily flammable. Carefully guard against fire. Store wiping rags containing this material in metal cans with tight lids.]

## 1.3 ENVIRONMENTAL CONDITIONS

Apply coating when air and concrete temperature are between 35 degrees F and 100 degrees F.

## 1.4 TRAFFIC CONTROL

Allow no traffic, except sealing equipment, on the treated surface until dry.

## 1.5 EQUIPMENT

## 1.5.1 [Spray Equipment

Portable, truck mounted, or self-contained, mechanized spray equipment with nozzles designed to produce a flat, overlapping fan-shaped spray pattern. Clean tank interior and spray system prior to use.

## ]1.5.2 [Brushes and Rollers

Use brush with sufficient body and length of bristle to spread the compound in a uniform film. Use rollers of a type which do not leave a stippled texture.

## ]PART 2 PRODUCTS

## 2.1 MATERIALS

### 2.1.1 Linseed Oil-Mineral Spirits Compound

A blend of 60 percent boiled linseed oil and 40 percent mineral spirits conforming to [ASTM D235](#), Type I, by volume.

### 2.1.2 Linseed Oil Emulsion

[ASTM C309](#), Type 1.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Prepare hardened concrete surfaces to permit sealer penetration. [Use airblasting, sandblasting, waterblasting or other approved methods.] [Sandblast first then waterblast.] Immediately before sealer application, remove dust by airblasting.

### 3.2 APPLICATION

#### 3.2.1 Rate of Application

##### 3.2.1.1 Hardened Concrete

Two coat application of linseed oil-mineral spirits compound:

- a. First Coat: [one gallon per 360 square feet](#).
- b. Second Coat: [one gallon per 600 square feet](#). Apply the second coat as soon as the first coat is dry to the touch.

##### 3.2.1.2 Fresh Concrete

Apply one coat linseed oil emulsion before permanent set at the rate of [one gallon per 200 square feet](#).

#### 3.2.2 Method of Application

Apply using [spray] [brush and roller] technique.

-- End of Section --

## SECTION 09 97 23.17

## CORROSION INHIBITOR COATING OF CONCRETE SURFACES

08/16, CHG 1: 11/16

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 260 (1997; R 2016) Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 228.2R (2013) Report on Nondestructive Test Methods for Evaluation of Concrete in Structures

ASTM INTERNATIONAL (ASTM)

ASTM C876 (2015) Standard Test Method for Corrosion Potentials of Uncoated Reinforcing Steel in Concrete

ASTM C900 (2015) Standard Test Method for Pullout Strength of Hardened Concrete

ASTM G59 (1997; R 2014) Standard Test Method for Conducting Potentiodynamic Polarization Resistance Measurements

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Proposed Subcontractors; G[, [\_\_\_\_\_]]

List of Proposed Products; G[, [\_\_\_\_\_]]

Health and Safety Plan; G[, [\_\_\_\_\_]]

Reinforcement Corrosion Rate Testing Procedures and Equipment; G[, [\_\_\_\_\_]]

Environmental Protection Plan; G[, [\_\_\_\_\_]]

#### SD-02 Shop Drawings

Structure Corrosion Inhibitor System Application Areas; G[, [\_\_\_\_\_]]

Structure Repair Areas Prior to Inhibitor System Application; G[, [\_\_\_\_\_]]

Structure Testing Locations; G[, [\_\_\_\_\_]]

Structure Reinforcing Steel Test Wire Installation Locations and Installation Details; G[, [\_\_\_\_\_]]

#### SD-03 Product Data

Vapor Phase Corrosion Inhibitor; G[, [\_\_\_\_\_]]

Ionic Corrosion Inhibitor; G[, [\_\_\_\_\_]]

Surface Sealant; G[, [\_\_\_\_\_]]

Structure Repair Materials; G[, [\_\_\_\_\_]]

Structure Reinforcing Steel Test Wire; G[, [\_\_\_\_\_]]

Structure Reinforcing Steel Test Wire Enclosure; G[, [\_\_\_\_\_]]

Manufacturer's Storage and Handling Instructions; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Corrosion Inhibitor Selection and Application Plan; G[, [\_\_\_\_\_]]

Pre-Project Test Application Report; G[, [\_\_\_\_\_]]

Daily Checklists; G[, [\_\_\_\_\_]]

Final Acceptance Test Report and Maintenance Test Procedure; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

Manufacturer's Certificate; G[, [\_\_\_\_\_]]

Applicator's Certificate; G[, [\_\_\_\_\_]]

Evidence of Acceptable Variation Certificate; G[, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Safety Data Sheets (SDS); G[, [\_\_\_\_\_]]

Special Application Procedures For Extreme Temperatures; G[, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

## Final acceptance Test Report; G[, [\_\_\_\_\_]]

## 1.3 QUALITY ASSURANCE

## 1.3.1 Qualifications

Submit [Applicator's Certificate](#) documenting a minimum of 5-years of experience in the application and testing of vapor phase and ionic corrosion inhibitors, including the test methods described herein. Submit a [list of proposed subcontractors](#), including qualification statements, for review and approval if subcontractors will be utilized on the project.

## 1.3.2 Minimum Performance Requirements

## 1.3.2.1 Structure Life Extension

Submit [Manufacturer's certificate](#) that the proposed corrosion inhibitor system application will extend the structure service life a minimum of 10 years.

## 1.3.2.2 Corrosion Rate Reduction of Reinforcing Steel

Submit test data in the Final Acceptance Test Report that demonstrates a minimum reduction in reinforcement corrosion rate of 50 percent from the pre-application testing corrosion rate.

## 1.3.2.3 Water Penetration Rate Reduction of Concrete

Submit test data in the Final Acceptance Test Report that demonstrates a minimum reduction of 80 percent in the water penetration rate of concrete from the pre-application testing penetration rate.

## 1.3.2.4 Pullout Strength Increase of Concrete

Submit test data in the Final Acceptance Test Report that demonstrates a minimum increase of [500 psi](#) in the pullout strength of the concrete from the pre-application testing strength.

1.3.3 [Evidence of Acceptable Variation Certificate](#)

Submit documentation of any variations from this section that certifies the variation will not prevent the inhibitor system application from achieving the minimum performance requirement.

## 1.4 REGULATORY REQUIREMENTS

## 1.4.1 Environmental Protection

Submit an [environmental protection plan](#) for the corrosion inhibitor system application project that addresses all requirements of the SDS for the products utilized and assures compliance with all applicable regulations.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver corrosion inhibitor products in sealed and properly labeled containers. Store and handle products in accordance with the manufacturer's instructions. Submit [manufacturer's storage and handling instructions](#) as part of the product data submittal.

## 1.6 SAFETY METHODS

Comply with all applicable OSHA and local authority standards for personal protection, including the required record keeping and training. Submit compliance plan as part of the [Health and safety plan](#) submittal.

## 1.7 ENVIRONMENTAL CONDITIONS

### 1.7.1 Weather and Substrate Conditions

Consider present and forecasted weather conditions for each structure prior to product application. Do not apply inhibitor system if rain is forecasted during the application or within 4 hours after the application is completed. The substrate temperature, air temperature, humidity and other environmental conditions must be within the limits recommended by the manufacturer for proper application. Document all relevant environmental conditions and include in the Daily Checklist submittals.

## 1.8 EQUIPMENT, TOOLS, AND MACHINES

Apply the inhibitor system utilizing methods, tools, and equipment approved by the manufacturer. Application equipment may include brushes, rollers, power rollers, spray equipment, squeegees, brooms, and pressure injection systems. Include the proposed application equipment and methods in the Corrosion Inhibitor Selection and Application Plan submittal.

## 1.9 SEQUENCING AND SCHEDULING

### 1.9.1 [Structure Repair Areas Prior To Inhibitor System Application](#)

Repair damaged and delaminated concrete areas and cracks in accordance with Section [03 01 00 REHABILITATION OF CONCRETE](#). Exothermically weld or pin braze a test wire to the reinforcing steel where reinforcing steel is exposed during the repair process. Prepare the surface of the wire attachment area in accordance with the coating manufacturer's recommended procedures and apply a 100 percent solids epoxy coating to the test wire attachment location that covers all bare wire and affected areas of the reinforcement. Allow the coating to cure in accordance with the manufacturer's instructions prior to proceeding with placement of [structure repair materials](#). Terminate the test wire in an enclosure. Prepare and submit shop drawings showing the location of all repair areas and proposed test wire installations. The submittal shall include a list of all proposed repair materials, repair material SDS, and manufacturer's recommended application procedures. The Designer of Record will review and approve the [structure reinforcing steel test wire installation locations and installation details](#) required prior to installation.

### 1.9.2 Surface Preparation of Concrete

Remove all existing coatings, laitance, contaminants, and any other substances that could interfere with the inhibitor penetration. Select removal methods appropriate for the structure and materials to be removed. Include proposed removal methods in the Corrosion Inhibitor Selection and Application Plan submittal.

### 1.9.3 Pre-Application Testing

#### 1.9.3.1 [Reinforcement Corrosion Rate Testing Procedures And Equipment](#)



Measure and document the corrosion rate of the reinforcing steel prior to inhibitor application. Document the location of test wires or reinforcing steel connections utilized for the corrosion rate measurements and each measurement location. Document the specific conditions of concrete moisture and surface temperature during the test. Identify a minimum of two separate test areas for each structure to be treated. Include a minimum of 25 measurement points in each test area. Utilize a combination of half-cell potential measurements collected in accordance with [ASTM C876](#) and linear polarization resistance measurements collected in accordance with [ASTM G59](#) to determine the corrosion rate of the reinforcing steel. Submit a list of all proposed corrosion rate testing procedures and test equipment within 2 weeks of the contract award. Alternate corrosion rate measurement techniques, such as electrochemical impedance spectroscopy (EIS) must be submitted to the Designer of Record for review and approval prior to testing. Report the corrosion rate in microamperes per square centimeter of reinforcing steel surface area in the test or in micrometers of steel loss per year.

#### 1.9.3.2 Chloride Content of Cement

Measure the total chloride ion content of the structure's concrete sand/cement paste at the depth of the first course of reinforcing steel in accordance with [AASHTO T 260](#). A pre-project test application of inhibitor is required for total chloride levels above 3,000 ppm in accordance with paragraph PRE-PROJECT TEST APPLICATION OF INHIBITOR. Include the chloride ion testing results and identify areas where pre-project test applications are required, if any, in the Corrosion Inhibitor Selection and Application Plan submittal.

##### 1.9.3.2.1 Pre-Project Test Application of Inhibitor

A pre-project test application of inhibitor is required for structures with total chloride levels above 3,000 ppm. Apply the test application to a representative section of the high-chloride structure area to be treated. Follow the application procedures included in the Corrosion Inhibitor Selection and Application Plan and PART 3 EXECUTION. Include all pre-application and post-application testing in order to ensure the minimum performance requirements can be achieved. Prepare and submit a [Pre-Project Test Application Report](#) to the Designer of Record for review and approval prior to proceeding with inhibitor application to high-chloride structures.

#### 1.9.3.3 pH of Concrete

Extract an approximate 1 in. diameter core of concrete to a minimum depth of the first course of reinforcing steel. Apply a multiple range pH indicator dye to the core in accordance with the dye manufacturer's procedures. Report the depth from the concrete surface at which a pH value of 11 or greater is indicated. Include the pH testing data in the Corrosion Inhibitor Selection and Application Plan submittal.

#### 1.9.3.4 Water Penetration Rate of Concrete

Measure the water penetration rate of the concrete surface in accordance with the Initial Surface Absorption Test described in [ACI 228.2R](#) for at least two locations within the area to be treated with the inhibitor system. Include the results of the testing in the Corrosion Inhibitor Selection and Application Plan submittal.

#### 1.9.3.5 Pullout Strength of Concrete

Measure the pullout strength of the concrete in accordance with **ASTM C900** at a minimum of two locations in the area to be treated with the inhibitor system. Include the test results in the Corrosion Inhibitor Selection and Application Plan submittal.

#### 1.9.4 Corrosion Inhibitor Selection and Application Plan

Prepare and submit a specific plan for **structure corrosion inhibitor system application areas** included in the project. At a minimum, include the product selections, structure areas to be treated, surface preparation requirements, application methods, application sequence and timing, and application rates that are based on the pre-application testing results. Include all pre-application testing data and analysis in the plan. Include shop drawings identifying the **structure testing locations**. Identify areas that require pre-project test applications based on excessive chloride ion levels. Submit the Corrosion Inhibitor Selection and Application Plan for review by the Designer of Record.

#### 1.9.5 Corrosion Inhibitor Application

Apply the corrosion inhibitor system in accordance with the approved plan. Monitor and record the quantity of inhibitor applied to the surface, application method, surface temperature, and any other data or observations required by the plan. Inspect the surface for residue upon completion of the inhibitor application to ensure all of the inhibitor has penetrated the concrete surface. Apply a light spray of water if necessary to aid inhibitor penetration. After the corrosion inhibitor application and penetration is complete clean the concrete surface of any remaining residue in accordance with the manufacturer's recommendations.

#### 1.9.6 Post-Application Testing and Minimum Performance Requirements

Perform post-application testing a minimum of 60 days after completion of the corrosion inhibitor system application. Perform post-application testing utilizing the same instrumentation and test procedures at the same locations as those utilized during the pre-application testing. Include the post-application testing results in the Final Acceptance Test Report. The minimum acceptable performance criteria are included in paragraph MINIMUM PERFORMANCE REQUIREMENTS.

##### 1.9.6.1 Corrosion Rate of Reinforcing Steel

Compare the pre-application test results and the post-application test results to determine the extent of corrosion rate reduction.

##### 1.9.6.2 Water Penetration Rate of Concrete

Compare the pre-application test results and the post-application test results to determine the reduction in water penetration rate.

##### 1.9.6.3 Pullout Strength of Concrete

Compare the pre-application test results and the post-application test results to determine the increase in pullout strength.

## PART 2 PRODUCTS

### 2.1 SYSTEM DESCRIPTION

The corrosion inhibitor system will consist of an organic vapor phase inhibitor, an ionic inhibitor or a combination of both inhibitors. Apply the organic vapor phase inhibitor first when a combination of inhibitors is utilized. In addition to the inhibitor system a reactive silicone surface sealant or surface protection coating will be applied. Submit a [list of proposed products](#) for the corrosion inhibitor system application. Include product [Safety Data Sheets \(SDS\)](#), warranty information and the manufacturer's recommended [special application procedures for extreme temperatures](#) and testing procedures in the submittal.

## 2.2 MATERIALS

### 2.2.1 Penetrating [Vapor Phase Corrosion Inhibitor](#)

A solution of organic amine carboxylate compounds that migrate in the gas phase through the cement pores to form a corrosion inhibiting film on the reinforcing steel surface.

### 2.2.2 Penetrating [Ionic Corrosion Inhibitor](#)

A solution containing chemically reactive water-soluble inorganic silicates designed to act as an anodic inhibitor on the surface of the reinforcing steel.

### 2.2.3 [Surface Sealant](#)

A chemically reactive water dispersion of a silane/siloxane mixture that forms an insoluble cross-linked silicone membrane within the concrete matrix.

### 2.2.4 [Structure Reinforcing Steel Test Wire](#)

Type THWN stranded copper conductor, not less than No. 10 AWG, of sufficient length to extend from the structure connection to the test wire enclosure without splicing. Terminate structure test wires in the test wire enclosure with solderless copper lugs.

### 2.2.5 [Structure Reinforcing Steel Test Wire Enclosure](#)

A surface/wall or post mounted enclosure to suit field conditions. Enclosure and cover constructed of non-metallic materials or hot-dip galvanized steel containing an insulated terminal board. Mounting post, where necessary, constructed of galvanized rigid conduit fitted with insulating bushings to protect the test wire from damage.

## PART 3 EXECUTION

### 3.1 [DAILY CHECKLISTS](#)

Complete a checklist for each day of work on the structures included in the project. Record, at a minimum, the following information on the daily checklist: concrete surface temperature immediately prior to and after inhibitor application, or every 2 hours if there is a possibility of extreme temperature; concrete surface cleaning and preparation equipment and methods; concrete relative moisture immediately prior to inhibitor application; time of application and application equipment for each component; rate of application of each component; extent of surface treated; application method utilized; tests performed; testing locations;

and any other requirements identified in the Corrosion Inhibitor Selection and Application Plan.

### 3.2 SURFACE PREPARATION

Examine all surfaces for cleanliness prior to application. Clean surfaces of visible contamination, coatings, sealants, debris, oils and fuels, and other similar materials. Treatment areas may be damp but no water ponding is permitted on flat horizontal surfaces. Measure and record concrete surface temperature immediately prior to inhibitor application. Do not apply inhibitor if concrete surface temperature is below 35 degrees F. Consult the manufacturer for special application procedures if the concrete surface temperature is in excess of 100 degrees F. Submit the special application procedures to the Designer of Record for review prior to application. Prepare the concrete surface for inhibitor application in accordance with the manufacturer's recommendations. Provide protection for equipment and structures in close proximity to the inhibitor application area to guard against overspray or product spillage. Use plastic sheeting to protect glass and decorative structure components and equipment from unintended inhibitor contact.

### 3.3 APPLICATION OF VAPOR PHASE CORROSION INHIBITOR

Apply the vapor phase inhibitor to the structure surface at the rate identified utilizing the methods, tools and equipment identified in the Corrosion Inhibitor Selection and Application Plan. Verify that the recommended amount of inhibitor has penetrated the structure surface. Multiple applications may be required to achieve the recommended application rate. Do not overspray or allow the inhibitor product to be lost due to run off. Replace any lost product with sufficient additional product to achieve the recommended application rate. Apply a light spray of water to the treated surface after each application to assist the inhibitor penetration into the concrete. Inspect the treated surface following application. Minimal to no residue should remain following the application. Clean the concrete surface of any residue in accordance with the manufacturer's recommendations. Perform post-application testing identified in this section.

### 3.4 APPLICATION OF IONIC CORROSION INHIBITOR

Apply the ionic inhibitor to the structure surface at the rate identified utilizing the methods, tools and equipment identified in the Corrosion Inhibitor Selection and Application Plan. Verify that the recommended amount of inhibitor has penetrated the structure surface. Multiple applications may be required to achieve the recommended application rate. Do not overspray or allow the inhibitor product to be lost due to run off. Replace any lost product with sufficient additional product to achieve the recommended application rate. Inspect the treated surface following application. Minimal to no residue should remain following the application. Clean the concrete surface of any residue in accordance with the manufacturer's recommendations. Perform post-application testing identified in this section.

### 3.5 APPLICATION OF COMBINED VAPOR PHASE AND IONIC CORROSION INHIBITOR SYSTEM

Apply the vapor phase organic inhibitor first when a combination of vapor phase and ionic inhibitors are used together on the same structure. Follow the manufacturer's recommendations regarding the time period between application of the vapor phase inhibitor and the ionic phase inhibitor.

Utilize the application specifications identified above for each type of inhibitor. Perform post-application testing identified in this section.

### 3.6 APPLICATION OF SURFACE PROTECTION COATING

#### 3.6.1 Surface Sealant

Prepare the concrete surface in accordance with the manufacturer's recommendations. Apply surface sealants to the structure surface at the rate identified utilizing the methods, tools and equipment identified in the Corrosion Inhibitor Selection and Application Plan. Verify that the recommended amount of sealant has penetrated the structure surface. Multiple applications may be required to achieve the recommended application rate.

#### 3.6.2 Protective and Decorative Coatings

Inspect and clean the concrete surface of residue that may interfere with the bonding of a surface protective or decorative coating. Separate specifications will be provided when protective and decorative coatings are included in the project. Perform post-application testing prior to the application of the protective and decorative coatings.

### 3.7 FINAL ACCEPTANCE TEST REPORT AND MAINTENANCE TEST PROCEDURE

Prepare and submit a [Final Acceptance Test Report](#). Include, at a minimum, the following: as-built drawings showing all structure repair areas, test wire installation locations, pre-application test locations, inhibitor application areas, and post application test locations; all post-application test results; post-application test data analysis and evaluation of acceptance criteria for corrosion rate reduction of the reinforcing steel, water penetration rate reduction of the concrete, and pullout strength increase of the concrete; a statement that the corrosion inhibitor system application will extend the life of the structure a minimum of 10 years; and recommended maintenance testing procedures and frequency to ensure compliance with the minimum 10 year structure life extension requirement.

-- End of Section --

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## SECTION 10 11 00

## VISUAL DISPLAY UNITS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## ASTM INTERNATIONAL (ASTM)

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM F148 (2013) Binder Durability of Cork Composition Gasket Materials

ASTM F152 (1995; R 2009) Tension Testing of Nonmetallic Gasket Materials

ASTM F793/F793M (2020) Standard Classification of Wall Coverings by Use Characteristics

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

## UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.2 DEFINITIONS

The term **visual display unit** when used herein includes presentation boards, markerboards, tackboards, board cases, display track systems, horizontal sliding units, copyboards, interactive whiteboards, and projection screens; submit manufacturer's descriptive data and catalog cuts plus manufacturer's installation instructions, and cleaning and maintenance instructions. Provide visual display units from manufacturer's standard product line. Submit **certificate of compliance** signed by Contractor attesting that visual display units conform to the requirements specified.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Placement Schedule; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Visual Display Unit; G[, [\_\_\_\_\_]]

Projection Screen; G[, [\_\_\_\_\_]]

## SD-04 Samples

Aluminum; G[, [\_\_\_\_\_]]

Hardwood; G[, [\_\_\_\_\_]]

Porcelain Enamel; G[, [\_\_\_\_\_]]

Cork; G[, [\_\_\_\_\_]]

Fabric; G[, [\_\_\_\_\_]]

Vinyl Wall Covering; G[, [\_\_\_\_\_]]

Glass; G[, [\_\_\_\_\_]]

## SD-07 Certificates

- [ Indoor air quality for markerboards; S
- ] [ Indoor air quality for tackboards; S
- ] [ Indoor air quality for projection screen; S
- ] Certificate of Compliance

## SD-08 Manufacturer's Instructions



Manufacturer's Cleaning Instructions

Manufacturer's Printed Installation Instructions

SD-10 Operation and Maintenance Data

Visual Display Units, Data Package 1; G[, [\_\_\_\_]]

1.4 CERTIFICATIONS

1.4.1 Indoor Air Quality

1.4.1.1 Indoor Air Quality for Visual Display Products

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in the manufacturer's original unopened containers and store them in a clean dry area with temperature maintained above **50 degrees F**. Stack materials according to manufacturer's recommendations. Allow visual display units to acclimate to the building temperature for 24 hours prior to installation.

1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for period of [one year][\_\_\_\_][ years] from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 MATERIALS

For each type, submit a section of core material and backing showing the lamination of porcelain enamel coating on steel, colored cork, natural cork, woven fabric, non-woven fabric, or vinyl wall covering, as applicable. Submit a sample of hardwood, plastic laminate finish, or glass type, as applicable. Provide minimum **4 by 4 inch** samples, or larger, showing range of color.

Submit manufacturers' descriptive product data for [each type of] **visual display unit** indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for [each type of] visual display unit in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

2.1.1 Porcelain Enamel

Provide markerboard writing surface composed of porcelain enamel fused to a nominal **28 gauge** thick steel, laminated to a minimum **1/4 inch** thick core

material with a steel or foil backing sheet. Writing surface must be capable of supporting paper by means of magnets. Markerboard surface for display track system may be a powder paint dry erase surface adhered to a nominal 18 gauge thick steel.

#### 2.1.1.2 Cork

Provide a continuous resilient sheet made from soft, clean, granulated cork relatively free from hardback and dust and bonded with a binder suitable for the purpose intended; wearing surface to be free from streaks, spots, cracks or other imperfections that would impair its usefulness or appearance. Provide seasoned material and a clean cut made not less than 1/2 inch from the edge and must show no evidence of soft sticky binder.

##### 2.1.1.2.1 Colored Cork

Provide colored cork composed of pure cork and natural color pigments that are combined under heat and pressure with linseed oil. Colored cork must be colored throughout and be washable. The burlap backing must be deeply imbedded and keyed to the work sheet being partially concealed in it and meeting the requirements of ASTM F148.

##### 2.1.1.2.2 Natural Cork

Provide a light tan natural cork composed of a single layer of pure grain natural cork without backing or facing. Cork sheets must have a tensile strength of not less than 40 psi when tested in accordance with ASTM F152.

#### 2.1.1.3 Woven Fabric

Provide [plain][\_\_\_\_\_] weave fabric with [100 percent polyester] [\_\_\_\_\_] fiber content and [16 oz. plus or minus 0.5 oz. per lineal yard] for 60 inch wide fabric [\_\_\_\_\_] minimum total weight. Fabric must have a Class A flame spread rating of 0-50 and smoke development rating of 0-450 in accordance with ASTM E84.

#### 2.1.1.4 Non-Woven Fabric

Provide a non-woven, hooktape compatible fabric with a [backed] [100 percent polyester] [,] [100 percent polyolefin] [or] [100 percent nylon] [\_\_\_\_\_] fiber content and [11 oz. plus or minus 0.5 oz. per lineal yard for 60 inch wide fabric] [\_\_\_\_\_] minimum total weight. Fabric must have a Class A flame spread rating of 0-50 and smoke development rating of 0-450 in accordance with ASTM E84.

#### 2.1.1.5 Vinyl Wall Covering

Provide vinyl wall covering conforming to ASTM F793/F793M, Category V with a Class A flame spread rating of 0-50 and smoke development rating of 0-450 in accordance with ASTM E84.

#### 2.1.1.6 Aluminum

Provide a minimum 0.06 inch thick, 6063-T5 or 6063-T6 aluminum alloy frame extrusion conforming to ASTM B221. Exposed aluminum must have [anodized, satin finish] [\_\_\_\_\_] . Use straight, single lengths wherever possible and keep joints to a minimum. Provide mitered corners with a hairline closure. Submit sections of frame, map rail, and marker rail, and [two] [\_\_\_\_\_] map hooks.

### 2.1.7 Hardwood

Provide exposed oak, walnut or mahogany hardwood with manufacturer's standard durable factory-applied stain and lacquer finish for frames, cabinets, and cases.

### 2.1.8 Glass

Provide tempered glass in accordance with ANSI Z97.1 and ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class I (clear), thickness as specified.

#### 2.1.8.1 Glass with Interlayer Color Coating

Provide glass markerboard writing surface composed of tempered, low-iron, extra clear, safety writing glass with polished edges. Provide glass with an interlayer color coating with a durable paint/glass bond that is fade resistant, water resistant, and heat resistant.

#### 2.1.8.2 Magnetic Glass

Provide magnetic glass markerboard writing surface composed of tempered, low-iron, extra clear, safety writing glass with polished edges and steel backing permanently adhered to the back of the glass.

## 2.2 PRESENTATION BOARD

Provide wall hung cabinet presentation board with lockable [double doors] [single door] [with] [without] a projection screen [that pulls down over the markerboard writing surface in the cabinet interior]. Attach doors to cabinet with piano hinges and include a catch or closure to keep doors closed when not in use. Provide a porcelain enamel markerboard writing surface on the interior of the cabinet with marker rail, a flip chart that can be hung on an interior door panel, and fabric covered tack surface on the interior door panels. Provide cabinet of [oak hardwood] [walnut hardwood] [mahogany hardwood] [plastic laminate] [\_\_\_\_], with [rectilinear] [bullnose or radius] [traditional] [\_\_\_\_] edge detailing. Dry erase markings must be removable with a felt eraser or dry cloth without ghosting. Provide each unit with an eraser and four different color compatible dry erase markers, and two keys.

## 2.3 MARKERBOARD

### 2.3.1 Porcelain Markerboard

Provide a factory assembled markerboard with a porcelain enamel[, magnetic] writing surface. Unit to be comprised of one piece, without joints whenever possible. When markerboard dimensions require delivery in separate sections, components must be prefit at the factory, disassembled for delivery and jointed at the site. Provide [hardwood oak] [hardwood walnut] [hardwood mahogany] [aluminum] [\_\_\_\_] frame with marker rail [constructed of the same material as the frame] [and] [[extending the full length of the markerboard] [\_\_\_\_] inches long]. The markerboard [does not include a map rail.] [includes a map rail with a tackable insert extending the full length of the markerboard, map hooks and clips for holding sheets of paper. Provide two map hooks for each 4 feet of map rail.] Dry erase markings must be removable with a felt eraser or dry cloth without ghosting. Supply each unit with an eraser and four different color

compatible dry erase markers. [Provide magnetic glass markerboard with [10] [\_\_\_\_\_] rare earth magnets.] [Provide markerboards that meet the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type).] [Provide certification of [indoor air quality for markerboards](#).] [Provide surface applied [direct print] [\_\_\_\_\_] graphics where required. Graphic type is [semivisible writing guidelines] [penmanship lines] [grid] [horizontal lines] [\_\_\_\_\_] [as indicated].]

### 2.3.2 Glass Markerboards with Interlayer Color Coating

Provide markerboard with a smooth finish[, magnetic glass] writing surface units to be comprised of one piece, without joints whenever possible. When markerboard dimensions require delivery in separate sections, components must be prefit at the factory, disassembled for delivery and jointed at the site. [Extend marker rail the full length of the markerboard.] [Marker rail is [\_\_\_\_\_] inches long]. The markerboard [does not include a map rail.] [includes a map rail with a tackable insert extending the full length of the markerboard, map hooks and clips for holding sheets of paper. Provide two map hooks for each 4 feet of map rail.] Dry erase markings must be removable with a felt eraser or dry erase cloth without ghosting. Supply each unit with an eraser and four different color compatible dry erase markers. [Provide magnetic glass markerboard with [10] [\_\_\_\_\_] rare earth magnets.] [Provide markerboards that meet the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type).] [Provide certification of indoor air quality for markerboards.] [Provide high resolution graphics[reverse surface applied] [printed on paper for insert behind glass] [surface applied, direct print] [\_\_\_\_\_] where required. Graphic type is [semivisible writing guidelines] [penmanship lines] [grid] [horizontal lines] [\_\_\_\_\_] [as indicated].]

## 2.4 TACKBOARDS

[Provide tackboards that meet the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type).] [ Provide certification or validation of [indoor air quality for tackboards](#).]

### 2.4.1 Cork

Provide tackboard consisting of a minimum [ 1/8 inch thick colored cork with burlap backing laminated to a minimum 3/8 inch thick insulation board or fiber board] [ 1/4 inch thick colored cork with burlap backing laminated to a minimum 1/4 inch thick hardboard] [ 1/8 inch thick natural cork laminated to a minimum 3/8 inch thick insulation board or fiber board] [ 1/4 inch thick natural cork laminated to a minimum 1/4 inch thick hardboard], and [a] [hardwood oak] [hardwood walnut] [hardwood mahogany] [an] [aluminum] [\_\_\_\_\_] frame.

### 2.4.2 Vinyl Covered

Provide tackboard consisting of vinyl wall covering laminated to a minimum [ 1/8 inch thick cork laminated to a minimum 3/8 inch thick insulation board or fiberboard] [ 1/4 inch thick cork laminated to a minimum 1/4 inch thick hardboard or particleboard] [ 1/2 inch thick insulation board or fiberboard], and [a] [hardwood oak] [hardwood walnut] [hardwood mahogany] [an] [aluminum] [\_\_\_\_\_] frame.

### 2.4.3 Fabric Covered

Provide tackboard consisting of a [woven] [non-woven] fabric covering laminated to a minimum [ 1/8 inch thick cork laminated to a minimum 3/8 inch thick insulation board or fiberboard] [ 1/4 inch thick cork laminated to a minimum 1/4 inch thick hardboard or particleboard] [ 1/2 inch thick insulation board or fiberboard], and [a] [an] [hardwood oak] [hardwood walnut] [hardwood mahogany] [an] [aluminum] [\_\_\_\_\_] frame.

## 2.5 BOARD CASE

Provide [surface] [recess] mounted board case with [hinged minimum 3/16 inch thick] [sliding minimum 1/4 inch thick] tempered glass doors that are lockable. Provide [a] [an] [aluminum] [hardwood oak] [hardwood walnut] [hardwood mahogany] [\_\_\_\_\_] case with mitered corners reinforced for rigidity. Provide doors [equipped with continuous piano hinges. Door glass framed with the case material, and reinforced at all corners. Door framing does not depend upon the glass for rigidity. Multiple door cases with an elbow catch] [sliding aluminum "H" molding at top and bottom of case]. The interior side of the back panel is tackable and composed of [a minimum 1/4 inch colored cork] [a minimum 1/4 inch natural cork] [a vinyl wall covering laminated to a minimum 1/4 inch cork] [[\_\_\_\_\_] laminated to a minimum 1/4 inch fiberboard] [\_\_\_\_\_]. Provide two keys for each unit.

## 2.6 DISPLAY TRACK SYSTEM

Method of display is a flexible and interchangeable system that consists of lightweight presentation components suspended from a wall mounted, linear, horizontal track. Track has [one] [two] [\_\_\_\_\_] levels to attach components. Track allows attached components to slide horizontally. Presentation components are capable of being lifted from the track and being relocated to allow for reconfiguration. Components must be capable of being installed on the track without the use of tools for installation, removal, and reconfiguration. The presentation components consist of a [retractable projection screen,] [tilted projection screen (top tilts forward),] [reversible panel with dry erase markerboard on both sides,] [reversible panel with markerboard on one side and woven fabric covered tack surface on the other,] [[1] [\_\_\_\_\_] [removable shelf,] [panel with adjustable flip chart,] [\_\_\_\_\_] and [display rail for setting presentation materials or a holder for displaying maps, presentation boards, drawings and other paper display materials up to a [1/8] [1/4] inch thickness]. Install and locate components on track in accordance with manufacturer's written recommendations. Provide markerboards with a marker rail. Markerboard surface accepts magnets. Dry erase markings are removable with a felt eraser or dry cloth without ghosting. Provide each unit with an eraser and four different color compatible dry erase markers.

## 2.7 HORIZONTAL SLIDING UNITS

Provide horizontal sliding unit composed of a fixed back panel, sliding panels, an aluminum track assembly, map rail and marker rail. Provide unit with [2] [3] [4] [\_\_\_\_\_] tracks. The fixed back panel is [markerboard] [tackboard]. Provide unit with [\_\_\_\_\_] markerboard sliding panel and [\_\_\_\_\_] tackboard sliding panel. The track assembly and exposed members, including panel edging and marker rail, are made of extruded aluminum. Reinforce frame assembly at corners. Sliding panels are suspended from the top and slide over the aluminum track using molded nylon ball bearing rollers at the top of the track and nylon guide rollers at the bottom of the track to eliminate vibration and to provide quiet and smooth operation of the panels. Sliding panels have finger pulls at each end. Provide a

map rail with a tackable insert extending the length of the horizontal sliding unit. The map rail has map hooks with clips for holding sheets of paper. Provide two map hooks for each 4 feet of map rail. Marker rail extends the full length of the horizontal sliding unit. Dry erase markings are removable with a felt eraser or dry cloth without ghosting. Provide each unit with an eraser and four different color compatible dry erase markers.

## 2.8 COPYBOARD

Provide wall mounted copyboard, 120V, UL listed, with [2] [\_\_\_\_\_] sided rotating screens, and [a built-in printer that prints letter size copies] [and] [capability to save and print to a Government furnished and Government installed PC and printer]. Copyboard surface [has grid lines] [and] accepts dry erase markers. Dry erase markings are removable with a felt eraser or dry cloth without ghosting. [Copyboard [has PC interface] [or] [is PC ready].] [Provide PC interface kit for each PC ready unit.] Copyboards [are hardwired] [have an electrical cord that plugs into an electrical wall outlet]. Comply with electrical work requirements in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide each copyboard with an eraser and three different color compatible dry erase markers.

## 2.9 INTERACTIVE WHITEBOARDS

Provide interactive whiteboards are composed of a wall mounted interactive touch screen/panel with infrared touch technology. System includes keyboard, conference camera, [short throw projector] [[connection to local area network (LAN)] and built-in wireless], remote control, pen, and audio. [Provide a system compatible with Government furnished and Government installed PC and printer] [Provide a system that includes a printer and that is compatible with a Government furnished and Government installed PC]. Interactive whiteboards [are hardwired] [have an electrical cord that plugs into an electrical wall outlet]. Comply with electrical work requirements in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 2.10 PROJECTION SCREEN

Provide [wall mounted] [ceiling mounted] [recessed mounted] motorized projection screen with 120V motor that is lubricated for life, quick reversal type, has overload protector, integral gears, and preset accessible limit switches. [Provide recessed mounted projection screens with an operable closure door and access panel.] Provide flame retardant, mildew resistant, [glass beaded] [white matte] [\_\_\_\_\_] screen [with [white] [black] masking borders] [that is tab tensioned]. Tab tensioned screens have a vinyl surface that is stretchable]. Bottom of screen fabric is weighted with a metal rod. Provide roller of rigid metal at least [3] [5] [\_\_\_\_\_] inches in diameter mounted on sound absorbing supports. Motor is [end mounted] [or] [motor-in-roller] design. Provide screen with a 3 position control switch to stop or reverse screen at any point. Install the switch in a flush electrical box with cover plate, location(s) as shown on the Electrical drawings. All conduit and wiring from the control switch to the projection screen is furnished and installed by the Contractor. [Provide ceiling recessed case of [extruded aluminum] [or] [wood with metal lined motor compartment]]. [Provide [wall] [ceiling] mounted case of [aluminum] [or] [steel] [or] [wood]. Wood case is finished in [plastic laminate] [light oak] [medium oak] [walnut] [cherry] [mahogany] [\_\_\_\_\_] ]. Screen is UL listed. Comply with electrical work requirements in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. [Provide projection screens that meet the emissions requirements of

CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type).]

[Provide certification of indoor air quality for projection screens.]

2.11 COLOR

Provide finish colors for required items [as specified in Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers].

PART 3 EXECUTION

3.1 PLACEMENT SCHEDULE

[Location, size and mounting height of visual display units as shown on the drawings.] [Provide visual display units as follows:

Room Name and Number	Board Type	Board Size	Wall Location	Mounting Height
[_____]	[_____]	[_____]	[_____]	[_____]

]

Mounting height is defined as distance from finished floor to top of the visual display unit frame.

3.2 INSTALLATION

Do not install items that show visual evidence of biological growth. Perform installation and assembly in accordance with manufacturer's printed installation instructions. Use concealed fasteners. Attach visual display units to the walls with suitable devices to anchor each unit. Furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Do not initiate installation until completion of room painting and finishing operations. Install visual display units in locations and at mounting heights indicated. Install visual display units level and plumb, and if applicable align doors and adjust hardware. Repair or replace damaged units as directed by the Contracting Officer.

3.3 CLEANING

Clean writing surfaces in accordance with manufacturer's cleaning instructions.

-- End of Section --

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## SECTION 10 14 00.10

EXTERIOR SIGNAGE  
08/17, CHG 1: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## AMERICAN WELDING SOCIETY (AWS)

AWS C1.1M/C1.1 (2012) Recommended Practices for Resistance Welding

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A924/A924M (2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM A1011/A1011M (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM C1036	(2021) Standard Specification for Flat Glass
ASTM D3841	(2016) Standard Specification for Glass Fiber-Reinforced Polyester Plastic Panels
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
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SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3611	(2011; Rev E; Stabilized (S) 2011) Plastic Sheet, Polycarbonate General Purpose
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## 1.2 GENERAL REQUIREMENTS

All exterior signage must be provided by a single manufacturer. Exterior signage must be of the design, detail, sizes, types, and message content shown on the drawings, must conform to the requirements specified, and must be provided at the locations indicated. Submit exterior signage schedule in electronic media with spread sheet format. Spread sheet must include sign location, sign type, and message. Signs must be complete with lettering, framing as detailed, and related components for a complete installation. Each sample must consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded. Submit [three] [\_\_\_\_\_] color samples for each material requiring color and 12 inch square sample of sign

face color sample.

#### 1.2.1 Wind Load Requirements

Exterior signage must be designed to withstand [\_\_\_\_\_] mph windload. Submit design analysis and supporting calculations performed in support of specified signage.

#### 1.2.2 Character Proportions and Heights

Letters and numbers on indicated signs for handicapped-accessible buildings must have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs must be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted.

#### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Approved Detail Drawings; G[, [\_\_\_\_\_] ]

##### SD-03 Product Data

Modular Exterior Signage System

Installation

Exterior Signage; G[, [\_\_\_\_\_] ]

Wind Load Requirements

##### SD-04 Samples

Exterior Signage; G[, [\_\_\_\_\_] ]

##### SD-10 Operation and Maintenance Data

Protection and Cleaning; G[, [\_\_\_\_\_] ]

#### 1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters must be the standard product of a manufacturer regularly engaged in the manufacture of the products. Items of equipment must essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

#### 1.5 DELIVERY AND STORAGE

Materials must be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry

area in accordance with manufacturer's instructions.

#### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period must be provided.

#### 1.7 EXTRA STOCK

Provide [\_\_\_\_\_] extra interchangeable message panels and extra stock of the following: [[\_\_\_\_\_] message bars of each color and size for sign types [\_\_\_\_\_] .] [[\_\_\_\_\_] pressure-sensitive letters in each color and size for sign type [\_\_\_\_\_] .] [[\_\_\_\_\_] changeable message strips for sign type [\_\_\_\_\_] .]

### PART 2 PRODUCTS

#### 2.1 MODULAR EXTERIOR SIGNAGE SYSTEM

Exterior signage must consist of a system of coordinated directional, identification, and regulatory type signs located where shown. Dimensions, details, materials, message content, and design of signage must be as shown. Submit manufacturer's descriptive data and catalog cuts.

##### 2.1.1 Free-Standing Base Mount Pylon/Monolith Type Signs

###### 2.1.1.1 Framing

Interior framing must consist of [aluminum] [or] [galvanized steel] tube columns welded to companion plates. Perimeter framing must consist of [aluminum] [or] [steel] angle framing welded to the post and plate system as designed. Framing members must be designed to permit [access to electrical equipment] [and] [panel removal]. Mounting must be provided as shown. Framing members of steel must be finished with semi-gloss baked enamel or two-component acrylic polyurethane. Openings must be sealed from moisture and made tamper-proof.

###### 2.1.1.2 Exterior Sheeting Panels

Modular panels must be provided in sizes shown on drawings. Panels must be fabricated a minimum of [ 0.090 inch thick [aluminum] [steel]] [ 0.125 inch thick fiberglass reinforced plastic (FRP)]. [Panels must be heliarc welded to framing system [\_\_\_\_\_] .] Top and end panels must be removable and must be secured by 3/16 inch socket head jack nuts. Finish for metal panels must be [semi-gloss baked enamel] [two-component acrylic polyurethane] [anodized conforming to AA DAF45].

###### 2.1.1.3 Mounting

Mount by securing to concrete foundation as indicated.

###### 2.1.1.4 Finishes

Base finish must be [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] [anodized conforming to AA DAF45] [\_\_\_\_\_] . Metal panel system finish must be [baked enamel or two-component acrylic polyurethane] [anodized conforming to AA DAF45 [\_\_\_\_\_] , as shown].

##### 2.1.2 Panel And Post/Panel Type Signs

#### 2.1.2.1 Posts

One-piece [aluminum] [or] [galvanized steel] posts must be provided with minimum 0.125 inch wall thickness. Posts must be designed to accept panel framing system described. The post must be designed to permit attachment of panel framing system without exposed fasteners. Caps must be provided for each post.

#### 2.1.2.2 Panel Framing System

Panel framing consisting of aluminum sections and interlocking track components must be designed to interlock with posts with concealed fasteners.

#### 2.1.2.3 Panels

Modular message panels must be provided in sizes shown on drawings. Panels must be fabricated a minimum of [ [0.080] [0.090] [0.125] inch aluminum] [ 0.125 inch acrylic] [ 0.125 inch fiberglass reinforced plastic (FRP)]. [Panels must be designed to be interchangeable.] [Panels with metal return sheeting must have welded corners, ground smooth.] [Panels must be heliarc welded to framing system.] [Face panels must be removable to provide access to electrical components.]

#### 2.1.2.4 Finishes

Post finish must be [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] [anodized conforming to AA DAF45] [\_\_\_\_\_]. Metal panel system finish must be [baked enamel or two-component acrylic polyurethane] [anodized conforming to AA DAF45] [\_\_\_\_\_], as shown].

#### 2.1.2.5 Mounting

[Provide permanent mounting by embedding posts in concrete foundation as indicated.] [Provide removable mounting by [[a steel] [an aluminum]] [[sleeve] [flange]] embedded in concrete as indicated.]

### 2.1.3 Changeable Letter Directories

#### 2.1.3.1 Frame and Trim

Aluminum alloy finish must be [\_\_\_\_\_].

#### 2.1.3.2 Header Plates

[Header plate must consist of background metal matching frame and having raised letters attached through the back.] [Header plate must consist of acrylic with raised acrylic letters.] [Header plate must consist of MP plastic with raised letters.]

#### 2.1.3.3 Door Glazing

Door glazing must be [clear safety or tempered glass minimum 1/4 inch thick.] [clear acrylic sheet 3/16 inch thick.] [clear polycarbonate sheet [3/16] [1/4] inch thick.]

#### 2.1.3.4 Door Construction

Door frame must be of same material and finish as surrounding frame. Corners must be mitered [, reinforced] [, welded], and assembled with concealed fasteners. Hinges must be standard with manufacturer, in finish to match frames and trim. Glazing must be set in frame with resilient glazing channels.

#### 2.1.3.5 Door Locks

Door locks must be manufacturer's standard and must be keyed alike.

#### 2.1.3.6 Fabrication

Frames and trim must be assembled with corners [reinforced] [welded] and mitered to hairline fit, with no exposed fasteners. Removable changeable directory panel must consist of [ 1/4 inch thick white acrylic with clear acrylic letter tracks] [exterior grade plywood] [aluminum] [rubber] back with [vinyl] [polycarbonate] [corkboard] covering backgrooved 1/4 inch on centers to receive letters.

#### 2.1.3.7 Finishes

Post finish must be [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] [anodized conforming to AA DAF45] [\_\_\_\_\_]. Metal panel system finish must be [baked enamel or two-component acrylic polyurethane] [anodized conforming to AA DAF45 [\_\_\_\_\_] , as shown].

#### 2.1.3.8 Mounting

Directories must be mounted to supporting structures with concealed fasteners in accordance with manufacturer's instructions.

#### 2.1.3.9 Changeable Letters

Changeable letters must be upper-case or upper and lower-case [helvetica medium] [\_\_\_\_\_]. Tabbed vinyl letters and numbers must be furnished in accordance with the [drawings] [and] [schedule].

### 2.2 ILLUMINATION

Concealed lighting must be provided within panel framing members. Lighting must be controlled by a photocell device. [Top] [Back] lighting must be provided by [T-12 slimline lamps, [120] [277] [\_\_\_\_\_] volt, 60-hertz, single-phase, Type 1, or Type 2 ballast] [\_\_\_\_\_]. Ballast must be integrally mounted, high power factor and rated for use down to minus 20 degrees F ambient starting temperature. Ballast and wiring within the sign must be in metal raceways. Electrical equipment must be UL or FM listed and comply with NFPA 70. Illumination must be evenly distributed. A switch on the interior of the sign must be provided to turn off power in the sign. Switch must be readily accessible when sign is open.

### 2.3 GRAPHICS FOR EXTERIOR SIGNAGE SYSTEMS

#### 2.3.1 Graphics

Signage graphics must conform to the following:

- [ a. [Cast] [Custom fabricated] [Plate] aluminum letters, [1/4] [1/2] [\_\_\_\_\_] inch thick must be provided and fastened to the message panel with concealed fasteners. Letters must project [\_\_\_\_\_] inches from

face of panel.]

- [ b. Pressure sensitive precision cut vinyl letters [with reflecting surface] [\_\_\_\_\_] must be provided.]
- [ c. Message must be applied to panel using the silkscreen process. Silkscreened images must be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art must be defined as artwork that is a first generation pattern of the original specified art. Edges and corners must be clean. Rounded corners, cut or ragged edges, edge buildup, bleeding or surfaces pinholes will not be accepted.]
- [ d. Message letters must be cut out from panel. Panel cutouts must be backed with [ 0.080 inch FRP] [ 0.125 inch acrylic] where cutouts occur.  
]
- [ e. Message must be cut out from panel. Acrylic letters [1/8] [1/4] [1/2] inch thick must be projected through the cutout area and chemically welded to 0.125 inch thick acrylic backup sheet.]
- [ f. Message must be embedded in FRP sheet and completely covered with thermosetting polyester resin. Message must be embedded minimum 1/32 inch. Sheets must be processed in one piece, in one process, to prevent delamination.]
- [ g. Message must be applied using the frisket method. Photomechanically reproduced graphic masks must be applied to the sign face which has been coated with the graphics color. A background must then be applied to the exposed surfaces. Handcut masks will not be accepted. Edges that are nicked, cut, or ragged will not be acceptable. A protective overcoat containing UV-resistant additives must be applied.]
- [ h. Message must be engraved in non-corrosive, three-ply fiberglass laminate. Message must be core color or paint filled multiple colors.]

### 2.3.2 Messages

See [drawings] [and] [schedule] for message content. Typeface: [Helvetica medium] [\_\_\_\_\_] . Type size [\_\_\_\_\_] [as indicated].

## 2.4 METAL PLAQUES

Design and location of plaques must be as indicated.

### 2.4.1 Cast Metal Plaques

#### 2.4.1.1 Fabrication

Cast metal plaques must have the logo, emblem and artwork cast in the [bas relief] [flat relief] [\_\_\_\_\_] technique. Plaques must be fabricated from [prime aluminum] [bronze] [yellow brass].

#### 2.4.1.2 Size

Plaque size must be [\_\_\_\_\_] [as indicated].

#### 2.4.1.3 Border

Border must be [flat band] [plain edge] [bevel] [custom ornamental as indicated] [\_\_\_\_\_].

#### 2.4.1.4 Background

Background texture must be [leather] [fine pebble] [\_\_\_\_\_].

#### 2.4.1.5 Mounting

Mounting must be [concealed] [rosettes and anchors] [rosettes and toggle bolts] [invisible] [\_\_\_\_\_].

#### 2.4.1.6 Finish

Finishes must consist of [aluminum light colored sandblasted background. Letters must be satin polished and entire plaque must be sprayed with two coats of clear lacquer.] [aluminum with background sprayed dark gunmetal colored lacquer. Letters must be satin polished and entire plaque sprayed with two coats clear lacquer.] [bronze with dark finish oxidized background. Letters must be satin polished and entire plaque sprayed with two coats of clear lacquer.] [[aluminum] [bronze] with sprayed background. Letters must be satin polished.]

### 2.4.2 Chemically Etched Metal Plaques

#### 2.4.2.1 Fabrication

Plaque must be chemically [single-] [double-] etched one-piece [brass] [bronze] [\_\_\_\_\_] [0.032] [0.064] [0.125] [0.250] inch thick.

#### 2.4.2.2 Size

Plaque size must be [\_\_\_\_\_] [as shown].

#### 2.4.2.3 Finish

[Single-etched raised areas must be in [gold-tone] [silver-tone] [bronze-tone] finish and recessed areas must be colorfilled.] [Double-etched raised areas must be [gold-tone] [silver-tone] and recessed textured areas must be [gold-tone] [silver-tone] colorfilled.]

### 2.4.3 Frost and Surface Oxidized Plaques

#### 2.4.3.1 Fabrication

Plaque must be frosted and surface oxidized one - piece [anodized aluminum] [brass] [bronze] [stainless steel] [0.040] [0.125] inch thick.

#### 2.4.3.2 Size

Plaque size must be [\_\_\_\_\_] [as shown].

#### 2.4.3.3 Finish

[Material finish must be [satin] [polished].] [Frosted areas must be oxidized [black for aluminum or stainless steel] [or] [black or brown, for brass or bronze].]

## 2.5 DIMENSIONAL BUILDING LETTERS



### 2.5.1 Fabrication

Letters must be fabricated from [cast aluminum] [cast bronze] [ 0.090 inch aluminum sheet] [ 0.125 inch aluminum sheet] [extruded aluminum] [\_\_\_\_\_]. Letters must be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters must be packaged for protection until installation.

### 2.5.2 Typeface

Typeface must be [helvetica medium] [\_\_\_\_\_] [as indicated].

### 2.5.3 Size

Letter size must be [\_\_\_\_\_] [as indicated].

### 2.5.4 Finish

[Anodized aluminum] [Baked enamel or two-component acrylic polyurethane] [[Polished] [Oxidized] bronze with clear coat] finish must be provided.

### 2.5.5 Mounting

[Threaded studs] [Steel U-bracket, cap screws, and expansion bolts] of number and size as recommended by manufacturer, must be used for concealed anchorage. Letters which project from the building line must have stud spacer sleeves. Letters, studs, and sleeves must be of the same material. Supply templates for mounting.

## 2.6 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products must conform to [ASTM B209](#) for sheet or plate, [ASTM B221](#) for extrusions and [ASTM B26/B26M](#) or [ASTM B108/B108M](#) for castings. Aluminum extrusions must be provided at least [1/8 inch](#) thick and aluminum plate or sheet at least 16 gauge thick. Welding for aluminum products must conform to [AWS C1.1M/C1.1](#).

## 2.7 ANODIC COATING

Anodized finish must conform to [AA DAF45](#) as follows:

- [ Clear (natural) designation AA-M10-C22-A31, Architectural Class II [0.4 mil](#) or thicker.]
- [ Integrated color anodized designation AA-M10-C22-A32, Architectural Class [0.4 to 0.7 mil.](#)]
- [ Electrolytically deposited color - anodized designation AA-M10-C22-A34, Architectural Class II [0.4 to 0.7 mil.](#)]

## 2.8 ORGANIC COATING

Clean, prime and give surfaces a [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] finish in accordance with [NAAMM AMP 500](#), [AMP 505](#), with total dry film thickness not less than [1.2 mils](#).

## 2.9 STEEL PRODUCTS

Structural steel products must conform to [ASTM A36/A36M](#). Sheet and strip steel products must conform to [ASTM A1011/A1011M](#). Welding for steel products must conform to [AWS D1.2/D1.2M](#).

#### 2.10 CAST BRONZE

Fabricate components with sharp corners, flat faces, and accurate profiles. Remove and polish burrs and rough spots. Finish faces to a uniform high luster. Cast bronze must be in accordance with [ASTM B62](#).

#### 2.11 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting must be 5 to 7 year premium type and must be in accordance with the flammability requirements of [ASTM E84](#) and must be a minimum [0.003 inch](#) film thickness. Film must include a precoated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

#### 2.12 GLASS

Glass must be in accordance with [ASTM C1036](#), Type I, Class 1, Quality q3 and [ANSI Z97.1](#).

#### 2.13 FIBER-REINFORCED POLYESTER (FRP) PANELS

Fiber-reinforced polyester (FRP) must be in accordance with [ASTM D3841](#), Type II, Grade 1, Class 124, [\_\_\_\_\_] [as indicated].

#### 2.14 ACRYLIC SHEET

Acrylic sheet must be in accordance with the flammability requirements of [ASTM E84](#) and must conform to [ANSI Z97.1](#).

#### 2.15 POLYCARBONATE SHEET

Polycarbonate sheet must conform to [SAE AMS3611](#).

#### 2.16 ANCHORS AND FASTENERS

Exposed anchor and fastener materials must be compatible with metal to which applied and must match in color and finish and must be non-rusting, non-corroding, and non-staining. Exposed fasteners must be tamper-proof.

#### 2.17 SHOP FABRICATION AND MANUFACTURE

##### 2.17.1 Factory Workmanship

Work must be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled must be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws must be drilled or punched. Drilling and punching must produce clean, true lines and surfaces. Welding to or on structural steel must be in accordance with [AWS D1.1/D1.1M](#). Welding must be continuous along the entire area of contact. Exposed welds must be ground smooth. Exposed surfaces of work must have a smooth finish and exposed riveting must be flush. Fastenings must be concealed where practical. Items specified to be galvanized must be by hot-dip process after fabrication if practical. Galvanization must be in accordance with [ASTM A123/A123M](#) and [ASTM A653/A653M](#), as applicable. Other metallic coatings of steel sheet must be in

accordance with [ASTM A924/A924M](#). Joints exposed to the weather must be formed to exclude water. Drainage and weep holes must be included as required to prevent condensation buildup.

#### 2.17.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces must be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

#### 2.17.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion resisting steel, and zinc-coated work, must be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Surfaces of items to be embedded in concrete must not be painted. Upon completion of work, damaged surfaces must be recoated.

#### 2.18 COLOR, FINISH, AND CONTRAST

Color must be [in accordance with Section [09 06 00 SCHEDULES FOR FINISHES](#).] [as indicated on the drawings.] [selected from manufacturers standard colors.] [[\_\_\_\_\_.] Color listed is not intended to limit the selection of equal colors from other manufacturers.] For buildings required to be handicapped-accessible, the characters and background of signs must be eggshell, matte, or other non-glare finish. Characters and symbols must contrast with their background - either light characters on a dark background or dark characters on a light background.

### PART 3 EXECUTION

#### 3.1 [INSTALLATION](#)

Signs, plaques, or dimensional letters must be installed in accordance with approved manufacturer's instructions at locations shown on the [approved detail drawings](#); submit drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location, each sign type, and message must be included. Circuits installed underground must conform to the requirements of Section [33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION](#). Steel conduits installed underground and illuminated signage mounted directly on buildings must be in conformance with the requirements of Section [26 20 00 INTERIOR DISTRIBUTION SYSTEM](#). Signs must be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces must not be installed until finishes on such surfaces have been completed. Submit manufacturer's installation instructions and cleaning instructions.

##### 3.1.1 Anchorage

Anchorage and fastener materials must be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated must include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag

bolts and screws for wood.

### 3.1.2 Protection and Cleaning

The work must be protected against damage during construction. Hardware and electrical equipment must be adjusted for proper operation. Glass, frames, and other sign surfaces must be cleaned in accordance with manufacturer's instructions. After signs are completed and inspected, cover all project identification, directional, and other signs which may mislead the public. Covering must be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Submit [six] [\_\_\_\_\_] copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions must include simplified diagrams for the equipment as installed. Signs must be cleaned, as required, at time of cover removal.

### 3.2 FIELD PAINTED FINISH

Miscellaneous metals and frames must be field painted in accordance with Section 09 90 00 PAINTS AND COATINGS. Anodized metals, masonry, and glass must be protected from paint. Finish must be free of scratches or other blemishes.

-- End of Section --

## SECTION 10 14 00.20

## INTERIOR SIGNAGE

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AA PK-1 (2015) Pink Sheets: Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings & Ingot

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2604 (2017a) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

ASTM D635 (2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

## INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1	(2017) Standard And Commentary Accessible and Usable Buildings and Facilities
ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code
NFPA 101	(2021) Life Safety Code
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)	
NIST SP 800-82	(2015; Rev 2) Guide to Industrial Control Systems (ICS) Security
U.S. DEPARTMENT OF DEFENSE (DOD)	
DOD 8510.01	(2020; Change 1-2020) Risk Management Framework (RMF) for DoD Information Technology (IT)
DODI 8500.01	(2014) Cybersecurity
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_]]

## SD-03 Product Data

Room Identification And Directional Signage System; G[, [\_\_\_\_\_]]

Room Identification Sign with Patient Information; G[, [\_\_\_\_\_]]

Stair Signage; G[, [\_\_\_\_\_]]

Exit Door Tactile Sign; G[, [\_\_\_\_\_]]

Building Directories; G[, [\_\_\_\_\_]]

Door Tags; G[, [\_\_\_\_\_]]

## SD-04 Samples

Interior Signage; G[, [\_\_\_\_\_]]

Software; G[, [\_\_\_\_\_]]

Room Identification And Directional Signage System; G[, [\_\_\_\_\_]]

Room Identification Sign with Patient Information; G[, [\_\_\_\_\_]]

Stair Signage; G[, [\_\_\_\_\_]]

Exit Door Tactile Sign; G[, [\_\_\_\_\_]]

Building Directories; G[, [\_\_\_\_\_]]

Door Tags; G[, [\_\_\_\_\_]]

## SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions; G[, [\_\_\_\_\_]]

Protection and Cleaning; G[, [\_\_\_\_\_]]

## ]1.3 EXTRA MATERIALS

Provide [\_\_\_\_\_] extra frames and extra stock of the following: [[\_\_\_\_\_] blank plates of each color and size for [all sign types included in project][\_\_\_\_\_].] [[\_\_\_\_\_] changeable message strips for sign type [\_\_\_\_\_].] Provide [[\_\_\_\_\_] paper inserts and [laser print templates to support end-user printing copy] [one][\_\_\_\_\_] copy of the **software** for user produced signs and inserts after project completion] [and equipment necessary for removal of signage parts and pieces.]

## ]1.4 QUALITY ASSURANCE

## 1.4.1 Samples

Submit **interior signage** samples of each of the following sign types showing typical quality, workmanship and color: [all sign types included in project] [Room Identification and Directional Signage System] [Room Identification with Patient Information], [Stair Signage], [Exit Door Tactile Sign], [Door Tags], [Building Directories], [Metal Plaques], [Dimensional Building Letters], [Pressure Sensitive Letters]. Approved

samples may be installed in the work, provided each sample is identified and location recorded.

#### 1.4.2 Detail Drawings

Submit detail drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, mounting height, shape and thickness of materials, and details of construction. Include a schedule showing the location, each sign type, and message.

#### 1.4.3 Sign Fabricator

Sign Fabricator to follow room number strategies created by designer. The room numbering system to be reviewed and approved by the Contracting Officer and command end users during the shop drawing phase, and prior to fabrication.

#### 1.4.4 Cybersecurity

- a. The Risk Management Framework (RMF) is the process by which information systems are accredited for operation by a designated official from the Using Military Department. It is the standard process under which all DoD information systems achieve and maintain their Authority To Operate. The cybersecurity process is documented in [DOD 8510.01](#) and [NIST SP 800-82](#). Refer to [UFC 4-010-06](#) and [DODI 8500.01](#) for additional requirements.
- b. All systems that are IP addressable or interface with the Assured Network required certification to operate. Coordinate with the Government to initiate and complete the accreditation process.
- c. Cybersecurity requires input from the system vendor or provider and support from the local IMD. The local IMD-IA office is the point of contact for all Cyber Security requirements. The local CMIO is the point of contact for all clinical and functional system requirements.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Package materials to prevent damage and deterioration during shipment, handling, storage and installation. Deliver products to the jobsite in manufacturer's original packaging and store in a clean, dry area in accordance with manufacturer's instructions.

### 1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective interior signage materials and workmanship for a period of [2] [\_\_\_\_\_] years from date of final acceptance of the work.

## PART 2 PRODUCTS

### 2.1 ROOM IDENTIFICATION AND DIRECTIONAL SIGNAGE SYSTEM

Provide signs, plaques, directories, and dimensional building letters that are standard products of manufacturers regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letter forms and graphics true and clean.



### [2.1.1 Panel Sign Systems

Provide [direct print acrylic with applied [tactile] [second surface] graphics, sign is fabricated of 0.375 inch acrylic in two layers with smooth edge conforming to ANSI Z97.1] [decorative laminate face with applied [tactile] graphics, sign is fabricated of a balanced core sandwiched between 0.035 inch standard grade high pressure laminated faces]. Provide signs that can accept [images] [raised copy and Braille with printable message inserts] [printable message inserts]. Provide paper or acetate inserts with a 0.080 inch thick non glare acrylic window to allow sign to be updated. [\_\_\_\_\_]

### ] [2.1.2 Modular Sign Systems

Provide manufactured pre-engineered component-based sign system, consisting of a combination of aluminum extrusions and injection molded parts, pre-engineered and designed to create an updatable sign system that allows for easy and inexpensive updates and changes. Provide system with incremental widths and heights that permit the assembly of multiple inserts of variable size to create a single sign. Provide a tamper-resistant sign which requires a special tool to change inserts composed of [extruded aluminum for applied graphics] [rigid plastic for applied graphics] [extruded aluminum with slots for secondary inserts]. [Provide continuous [extruded aluminum] [\_\_\_\_\_] [[interlocking] [removable]] endcaps in [[square] [radius] [bevel] [contour]] [1/8 inch] [1/4 inch] [\_\_\_\_\_] thick] profile. Sign inserts are required to be [front] [side] loading.

### ] 2.1.3 Standard Room Signs

Provide signs that include tactile letters, symbols and Braille for interior rooms or spaces where the sign is not likely to change over time. Tactile text descriptions are required for pictograms that are provided to identify a permanent room. Examples include interior signs that label restrooms, stairs, room numbers or letters, and room names. These permanent room signs can include paper inserts for updatable information.

#### 2.1.3.1 Tactile Letters, Symbols and Braille

Provide ADA compliant material per 36 CFR 1191 which is raised 1/32 inch from the first surface, has a minimum 5/8 inch in height and is an ADA acceptable font. The color of the tactile letters is required to contrast with the sign face color per ADA standards. The ADA required Braille has a minimum durometer reading of 90. All raised letters, numbers and symbols are to comply.

#### 2.1.4 Directional Signs

Directional signs provide arrows with messages which point to critical destinations such as departments, offices, or other pertinent destinations. These can be a panel sign system with a series of permanently attached messages or a modular system with updatable inserts. Directional signs have header panels with applied or direct print messages.

#### 2.1.5 Message Inserts

Provide updatable message inserts covered with a clear matte 0.015 inch vinyl protective overlay. The insert is [typeset message laser printed on paper card stock] [large format color print on white photo paper] [direct

printed clear acetate over large format color print on white photo paper]. [ Provide [ paper and] software with message template for creating text and symbols for computers identified for Government production of paper inserts after project completion.] Manufacturer is required to offer online ordering capabilities to facilitate and expedite ordering packages of replacement, color-coated paper inserts. [ Furnish one [suction] [\_\_\_\_\_] device to assist in removing face sheet.] [ Provide sliding inserts that slide horizontally exposing different graphic information as identified on the drawings.]

#### 2.1.6 Type of Mounting for Signs

Provide surface mounted signs mounted with [concealed mechanical fastening through the holders] [countersunk mounting holes in plaques and mounting screws]. Secure inserts in holders [with flexible plastic clips] [when captured by side profiles of extruded aluminum holders]. [Mount framed plaques with manufacturer's standard (1/6 inch) 1.59 mm thick closed cell vinyl foam with adhesive backing. Adhesive must be transparent, long aging, high tech formulation on two sides of the vinyl foam. Double-faced tape consisting of acrylic adhesive on polyurethane foam used in conjunction with silicone adhesive [magnetic tape].] Provide signs with aluminum ceiling/projecting mount attachment extrusion to secure to ceiling or wall surface, along with matting ceiling/projecting mount track extrusion for hanging, projecting, and double-sided signs. Provide mounting for ceiling/projecting mount attachment extrusion by mechanical fasteners, selected based on wall or ceiling conditions. Mount track extrusion hinges over width of mount attachment and secured with 3.5 by 0.06 mm (6-32 inch) by 6 mm (1/4 inch) cone point stainless steel set screws.

#### 2.1.7 Character Proportions and Heights

Letters and numbers on signs conform to 36 CFR 1191.

### [2.2 ROOM IDENTIFICATION SIGN WITH PATIENT INFORMATION

#### 2.2.1 Sign Faces

Provide sign faces of clear acrylic or PETG plastic with 0.125 inch thickness minimum, with dimensions of sign face being [manufacturer's standard] [as indicated]. Sign faces can be direct printed and contain two window openings for acrylic inserts; include a space for ADA compliant room tactile and Braille. Sign faces may also have approved printed logos for brand recognition.

#### 2.2.2 Sign Backs

Provide sign backs of acrylic or PETG plastic that is welded to the sign face and has two window openings for inserts. The window openings are minimum 0.1875 inch in depth. The dimensions of the sign back are equal to the sign face.

#### 2.2.3 Room Identification Tactile Letters

Provide ADA compliant material per 36 CFR 1191 which is raised 1/32 inch from the first surface, has a minimum 5/8 inch in height and is an ADA acceptable font. The color of the tactile letters is required to contrast with the sign face color per ADA standards. The ADA required Braille has a minimum durometer reading of 90.

#### 2.2.4 Risk Management Alert Inserts (RM)

Provide all signs with RM inserts. The RM inserts are required to fit into one of the two window openings in the sign back and be visible through one of the two window openings of the sign face. The tabs can be in the same position on all the RM inserts and labeled differently.

#### 2.2.5 Isolation Precaution Signage Inserts (IP)

Provide all signs with 5 IP inserts. The IP inserts are required to fit into the larger of the two window openings in the sign back and be visible through the corresponding window opening of the sign face. Stagger the tabs on each of the inserts.

### ] 2.3 STAIR SIGNAGE

Provide signs on stairs serving three or more stories with special signage within the enclosure at each floor landing conforming to NFPA 101. Indicate the floor level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair enclosure. Also, state the floor level of, and the direction to, exit discharge. Locate the signage inside the enclosure in a position that is visible when the door is in the open or closed position and install in conformance with 36 CFR 1191. Provide tactile for floor level designation in accordance with ICC A117.1.

### 2.4 EXIT DOOR TACTILE SIGN

Provide tactile sign with the message EXIT at each exit door that requires an exit sign to conform with NFPA 101. Sign tactile message is to comply with ICC/ANSI A117.1.

### 2.5 BUILDING DIRECTORIES

Provide building directories as lobby directories or floor directories, with a changeable directory listing consisting of the areas, which can include departments, offices, personnel and other destinations located within the facility as well as a map with "you are here" locations. Provide dimensions, details, and materials of sign and message content as indicated on the drawings.

#### 2.5.1 Header Panel

Header panel has [background metal to match frame] [acrylic with raised acrylic letters] [ES/MP plastic with raised letters] [\_\_\_\_\_].

#### 2.5.2 Directory Graphics

Provide graphics and text that are first generation from camera ready art.

##### [2.5.2.1 Orientation Map

Provide a color-coded floor plan graphic outline for each building level. Individual building functions and public accessible departments are identified using a unique color and numerical "address" number. Building and department names are tied to the floor plan's numerical address.

##### ] [2.5.2.2 Monitor Graphic Displan

The orientation map for each level of the building is displayed at all

times, along with the Department listing of names. The Government will verify their preference to list the names in alphabetical order, followed by the plan "address", or an alternate sequence.

#### ]2.5.2.3 Other Graphics

Graphic artwork is used to indicate the location of elevators, stairways, public restrooms, and information stations. Graphic artwork includes the macro-wayfinding terminology and locations, i.e. 1A, 1B, 2A, & 2B, or alternate language developed by the Government for wayfinding destinations.

#### ]2.5.3 Doors

##### 2.5.3.1 Door Glazing

Provide door glazing with 1/4 inch thick polished [clear] [tinted] glass, fully tempered in accordance with ASTM C1048 (Kind FT) and ANSI Z97.1.

##### 2.5.3.2 Door Construction

Provide extruded aluminum door frame of same finish as surrounding frame; mitered corners [, welded], and assembled with concealed fasteners. Provide continuous concealed hinges in [finish to match frames and trim] [stainless steel]. Set glazing in frame with clear silicone adhesive.

##### 2.5.3.3 Door Locks

Provide manufacturer's standard door locks; keyed alike. Provide two sets of keys.

##### 2.5.4 Fabrication

Provide extruded aluminum frames and trim with welded corners and mitered to a hairline fit, with no exposed fasteners.

##### 2.5.5 Illuminated Units

Provide illuminated directory units with concealed internal [top] [back] lighting with [LED] [\_\_\_\_\_] light source, internal wiring, and lead at wire for connection. [Units using LED light sources must have integral LED drivers. Units with remote LED drivers are not acceptable.] Electrical work complies with NFPA 70; UL or FM listed. Directory consists of [backlit photo negative directory strips and a black background.] [screen printed or vinyl copy applied to acrylic, metal, or high-pressure plastic laminate strips] [vinyl or screen printed lettering on plastic film held in interchangeable plastic carriers] [screen printed or vinyl copy laminated to magnetic tape] [updatable photo paper insert, printed and laminated] [changeable aluminum bands, painted and direct printed] [changeable aluminum insert slots that accept a user-printed cardstock insert]. Design of unit as indicated on the drawings. Provide unit with tinted [tempered safety solar glass] [\_\_\_\_\_] door.

##### 2.5.5.1 Construction

The directory is [1] [2] [4] [\_\_\_\_\_] inch[es] deep frame constructed of [aluminum with [[satin [black] [painted] [dark bronze]] [natural satin] [\_\_\_\_\_] anodized finish]] [\_\_\_\_\_] [wood with [natural] [stained] finish]. Unit is [[semi] [fully] recessed] [surface] [\_\_\_\_\_] mounted. Unit has a [3] [\_\_\_\_\_] inch header size and lettering as shown. Unit has a

[3/8] [\_\_\_\_\_] inch face door frame with concealed hinges and locking system or other secure method. Door frame matches [directory material and finish] [\_\_\_\_\_].

#### 2.5.5.2 Message Strips

Message strips are [photo negative type updatable photo paper by user] [sized in accordance with manufacturer's standard] [as indicated on the drawings] [\_\_\_\_\_]. Provide letters and numbers in accordance with the drawings.

#### 2.5.6 Non-Illuminated Unit

Directory consists of a non-illuminated unit with [machine or laser engraved copy in interchangeable acrylic, metal, or high-pressure plastic laminate strips] [screen printed or vinyl copy applied to acrylic, metal, or high-pressure plastic laminate strips] [vinyl or screen printed lettering on plastic film held in interchangeable plastic carriers] [screen printed or vinyl copy laminated to magnetic tape] [updatable photo paper insert, printed and laminated] [changeable aluminum bands, painted and direct printed] [changeable aluminum insert slots that accept a user-printed cardstock insert]. Design of unit as indicated on the drawings.

##### 2.5.6.1 Construction

The directory is [1] [2] [4] [\_\_\_\_\_] inch[es] deep frame constructed of [aluminum with [[satin [black] [painted] [dark bronze]] [natural satin] [\_\_\_\_\_] anodized finish]] [\_\_\_\_\_] [wood with [natural] [stained] finish]. Unit is [[semi] [fully] recessed] [surface] [\_\_\_\_\_] mounted. Unit has a [3] [\_\_\_\_\_] inch header size and lettering as shown. Unit has a [3/8] [\_\_\_\_\_] inch face door frame with concealed hinges and locking system or other secure method. Door frame matches [directory material and finish] [\_\_\_\_\_].

##### 2.5.6.2 Message Strips

Message strips are [updatable by user] [sized in accordance with manufacturer's standard] [as indicated on the drawings] [\_\_\_\_\_]. Provide letters and numbers in accordance with the drawings.

#### 2.5.7 Electronic Directory System

Coordinate electronic directory system requirements with Division 25 INTEGRATED AUTOMATION UFGSSs. Provide [non-interactive] [interactive] electronic directory. Provide electronic directory system as a complete turnkey system consisting of digital display, hardware, software connected through the local area network (LAN) to a [server] [cloud]. Electrical equipment is UL listed and complies with NFPA 70. Unit is [free-standing] [wall mounted].

##### 2.5.7.1 Hardware Requirements

Provide hardware as standard products of manufacturers regularly engaged in the production of electronic directory and digital wayfinding solutions. Hardware is [surface-mounted], [recessed], [free-standing kiosk] or [component system with mounting bracket]. [Landscape] [Portrait] orientation. Provide commercial grade, HD or UHD resolution flat panel LCD monitors. Provide commercial grade touch interfaces that can be serviced

independently of the monitor itself. Enclosures and kiosks fabricated in a US based facility.

2.5.7.2 Accessibility Requirements

Provide an electronic display [with interactivity] that meets the following ADA requirements: Directory does not protrude more than 4 inches from the wall, maintains a maximum touchable height of 48 inches with a reach of 10 inches installed at a minimum of 27 inches off the floor, and supports ADA compliance for hearing impaired by providing text based or video based messaging for any calling functionality.

2.5.7.3 Wayfinding Requirements

Provide mapping with animated wayfinding capable of sending maps digitally to users via SMS or QR codes.

2.5.7.4 Management and Support Requirements

All management of the digital directory is provided centrally through a password authenticated server. All listings and content must be backed up to a secondary or "cloud-based" location for redundancy. Providers of directory solutions must be capable of offering full initial input of tenant data, creation of all wayfinding maps, and any modifications to design through service or support offers.

2.6 DOOR TAGS

Provide one door tag plate for each room entry door. In size [as indicated on drawings] [\_\_\_\_\_]. Provide room number [to match architectural floor plan room number] [as determined by Contracting Officer].

2.6.1 Engraved Copy

Machine engrave letters, numbers, symbols, and other graphics into panel sign on face to produce precisely formed copy and sharp images, incised to uniform depth. Melamine plastic engraving stock used for ADA compliant graphic is three-ply lamination contrasting color core meeting ASTM D635.

2.7 METAL PLAQUES

2.7.1 Cast Metal Plaques

2.7.1.1 Fabrication

Provide cast metal plaques with the logo, emblem and artwork cast in the [bas relief] [flat relief] [\_\_\_\_\_] technique; fabricated from [prime aluminum] [bronze] [brass] [\_\_\_\_\_].

2.7.1.2 Border

Border is [flat band] [single line] [straight edge] [single line bevel] [double line] [bevel] [custom ornamental] [\_\_\_\_\_].

2.7.1.3 Finish

Letter Finish	[satin] [polished]
---------------	--------------------

Background Finish	[[light] [dark] aluminum] [[dark] [ ] bronze]
Background Texture	[leather] [pebble] [smooth] [sculpted] [ ]

2.7.1.4 Mounting

Provide [concealed] [rosettes and anchors] [rosettes and toggle bolts] [ ] mounting.

2.7.2 Chemically Etched Metal Plaques

2.7.2.1 Fabrication

Plaque is chemically etched one-piece or photochemically engraved metal sheet or plate [aluminum] [stainless steel] [brass] [commercial bronze] [zinc] [magnesium] [ ] [0.032] [0.064] [0.125] [0.250] [ ] inch thick.

2.7.2.2 Finish

[Single-etched raised areas are [gold-tone] [silver-tone] [bronze-tone] finish and recessed areas are color filled.] [Double-etched raised areas are [gold-tone] [silver-tone] and recessed textured areas are [gold-tone] [silver-tone] color filled.]

2.8 DIMENSIONAL BUILDING LETTERS

2.8.1 Fabrication

Letters are [cast] [cutout] [fabricated channel] [molded plastic] [aluminum] [bronze] [brass] [acrylic] [ ]. Package letters for protection until installation.

2.8.2 Size

Letter size is [ ] [as indicated]. Provide letter thickness that is [manufacturer's standard for the size of letter] [ ].

2.8.3 Finish

Provide [[mill] [clear anodized] [[light] [medium] [dark] anodized bronze]] [[polished] bronze with clear coat] [baked enamel] [powder coat] [two-component acrylic polyurethane] finish.

2.8.4 Mounting

[Threaded studs] [Steel U-bracket, cap screws, and expansion bolts] [concealed screw through structural rail] of number and size recommended by manufacturer; concealed anchorage. Letters which project from the mounting surface have [stud spacer sleeves] [ ]. Letters, studs, and sleeves are of the same material. Supply templates for mounting.

2.9 PRESSURE SENSITIVE LETTERS

2.9.1 Fabrication

Ensure that vinyl letter edges and corners of finished letterforms and

graphics are true and clean. Do not use letterforms and graphics with rounded positive or negative corners, nicked, cut, or ragged edges.

### 2.9.2 Size

Letter size: [as indicated] [\_\_\_\_\_].

## 2.10 MATERIALS

### 2.10.1 Aluminum Alloy Products

Aluminum extrusions are at least 1/8 inch thick, and aluminum plate or sheet are at least 0.0508 inch thick. Extrusions conform to ASTM B221; plate and sheet conforms to ASTM B209. Where anodic coatings are specified, alloy conforms to AA PK-1 alloy designation 514.0. Exposed anodized aluminum finishes are as shown. Welding for aluminum products conforms to AWS D1.2/D1.2M.

### 2.10.2 Anodic Coating

Anodized finish conforms to AA DAF45 as follows:

- a. [Clear (natural) designation AA-M10-C22-A31, Architectural Class II 0.4 mil or thicker.]
- b. [Integral color anodized designation AA-M10-C22-A32, Architectural Class 0.4 to 0.7 mil.]
- c. [Electrolytically deposited color-anodized designation AA-M10-C22-A34, Architectural Class II 0.4 to 0.7 mil.]

### 2.10.3 Organic Coating

Organic coating conforms to AAMA 2604, with total dry film thickness not less than 1.2 mils.

### 2.10.4 Plastic Laminate Sheet

ANSI/NEMA LD 3, general purpose HGS grade, 0.048 inch nominal thickness.

### 2.10.5 Fabrication and Manufacture

#### 2.10.5.1 Factory Workmanship

Holes for bolts and screws are drilled or punched. Drilling and punching produces clean, true lines and surfaces. Exposed surfaces of work have a smooth finish; exposed riveting is flush. Conceal fastenings where practicable.

#### 2.10.5.2 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces prevent galvanic or corrosive action.

### 2.10.6 Typeface

[ADA-ABA compliant font for Room Signs] [Helvetica Regular] [\_\_\_\_\_].

## 2.11 GRAPHICS



Provide signage graphics for modular signs to the following:

[2.11.1 Subsurface Copy

Copy is transferred to the back face of clear acrylic sheeting forming the panel face to produce precisely formed opaque image. This method bonds all sign elements (color, graphics, lettering, Braille and substrate) into a single unit.

] [2.11.2 First Surface Copy Direct Print (Non-Tactile)

Message may be applied to panel using a direct print process. Original art is defined as artwork that is a first generation reproduction of the specified art. Provide clean edges and corners.

] [2.11.3 Photopolymer

Integral graphics and Braille achieved by photomechanical stratification processes. Provide photopolymer used for ADA compliant graphics of the type that has a minimum durometer reading of 90. Tactile graphics are raised 1/32 inch from the first surface of plaque by photomechanical stratification process.

] [2.11.4 Engraved Copy

Machine engrave letters, numbers, symbols, and other graphics into panel sign on face to produce precisely formed copy and sharp images, incised to uniform depth. Melamine plastic engraving stock used for ADA compliant graphic is three-ply lamination contrasting color core meeting ASTM D635.

] [2.11.5 Graphic Blast Raised Copy

Background is sandblasted to a uniform depth of 1/32 inch leaving raised text and Braille. Background is factory-finished with polyurethane paint.

] [2.11.6 [Cast] [Fabricated] [Solid] Aluminum Letters

Provide 1/8 1/4 [ ] inch thick and fasten to the message panel with concealed fasteners.

] 2.12 COLOR, FINISH, AND CONTRAST

Provide color [as specified in Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers]. Finish of eggshell, matte, or other non-glare finish for all signs as required in handicapped-accessible buildings.

PART 3 EXECUTION

[3.1 PLACEMENT SCHEDULE

SIGNAGE PLACEMENT SCHEDULE				
Door/Room Number	Sign Type	Text	Insert(s)	Symbol/Remarks

SIGNAGE PLACEMENT SCHEDULE				
[_____]	[_____]	[_____]	[_____]	[_____]

3.2 INSTALLATION

Install signs plumb and true and in accordance with [approved manufacturer's instructions](#) at locations shown on the [detail drawings] [schedule below] [attachments]. Submit operating instructions outlining the step-by-step procedures required for system operation. The instructions include simplified diagrams for the system as installed, the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Provide each set permanently bound with a hard cover. The following identification must be inscribed on the covers: "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number. Submit in accordance with Section 01 78 23 OPERATING AND MAINTENANCE DATA. Mounting height and mounting location complies with [36 CFR 1191](#). Install required blocking. Do not install signs on doors or other surfaces until finishes on such surfaces have been installed. Signs installed on glass surfaces are installed with matching blank back-up plates in accordance with manufacturer's instructions. [Provide illuminated signage in conformance with the requirements of Section [26 51 00 INTERIOR LIGHTING](#).]

Do not install items that show visual evidence of biological growth.

3.2.1 Anchorage

Provide anchorage in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or shown includes slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Provide exposed anchor and fastener materials compatible with metal to which applied with matching color and finish.

- a. Signs mounted to painted gypsum board surfaces must be removable for painting maintenance.
- b. Mount signs to lay-in ceiling grids with clip connections to ceiling tees.
- c. Install signs mounted on metal surfaces with magnetic tape.
- d. Install signs mounted on fabric surfaces with hook and loop tape or pin mount.
- e. Install signs to workstation panels with panel clips.

3.2.2 [Protection and Cleaning](#)

Protect the work against damage during construction. Adjust hardware and electrical equipment for proper operation. Clean glass, frames, and other sign surfaces at completion of signage installation in accordance with the manufacturer's written instructions.

-- End of Section --



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## SECTION 10 14 53

TRAFFIC SIGNAGE  
02/15, CHG 1: 05/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 133 (2012; R 2016) Standard Specification for Preservatives and Pressure Treatment Processes for Timber

AASHTO M 168 (2007; R 2012) Standard Specification for Wood Products

AASHTO M 268 (2014) Standard Specification for Retroreflective Sheeting for Flat and Vertical Traffic Control Applications

AASHTO MASH (2016) Manual for Assessing Safety Hardware - Second Edition

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA T1 (2022) Use Category System: Processing and Treatment Standard

AWPA U1 (2022) Use Category System: User Specification for Treated Wood

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A320/A320M (2021a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service

ASTM A499 (2015, R 2020) Standard Specification for Steel Bars and Shapes, Carbon Rolled from "T" Rails

ASTM A500/A500M (2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and

## Shapes

ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A709/A709M	(2021) Standard Specification for Structural Steel for Bridges
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM D4956	(2013) Standard Specification for Retroreflective Sheeting for Traffic Control
ASTM F436/F436M	(2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

## U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA SHS	(2004; Supplement 2012) Standard Highway Signs
MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices
NCHRP 350	(1993) Recommended Procedures for the Safety Performance Evaluation of Highway Features

## 1.2 GENERAL

All signs must be in accordance with the **MUTCD**. Any signs not detailed on

the drawings must be in accordance with the [FHWA SHS](#).

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

[Traffic Sign Posts](#)

[FHWA Acceptance Letter](#)

[Traffic Sign Retroreflective Sheeting](#)

#### SD-04 Samples

[Flexible Posts](#)

## PART 2 PRODUCTS

### 2.1 TRAFFIC SIGN POSTS

#### 2.1.1 Steel Flanged Channel Section (U-Shape)

Fabricate steel posts from steel conforming to [ASTM A36/A36M](#) or [ASTM A499](#) and with a minimum yield strength of 30 ksi and a minimum tensile strength of 50 ksi. Punch or drill 5/16 to 3/8 inch diameter holes spaced at 1 or 2 inch centers along the centerline of the web prior to galvanizing for the entire length of the post. Galvanize posts after punching in accordance with [ASTM A123/A123M](#).

#### 2.1.2 Perforated Steel Tube

Fabricate steel posts from steel conforming to either [ASTM A653/A653M](#), structural steel, Grade 50, Class 1, coating designation G90 or [ASTM A1011/A1011M](#), structural steel, Grade 50, hot-dip galvanized after punching in accordance with [ASTM A123/A123M](#). Prepunch holes approximately 7/16 inch in diameter spaced at approximately 1 inch centers along each side of the tube for the entire length of the post.

#### 2.1.3 Steel Tube

Conform to [ASTM A500/A500M](#), Grade B or C, and hot-dip galvanized in accordance with [ASTM A123/A123M](#). [Manufactured triangular slip bases must be approved by the Federal Highway Administration (FHWA) for use under the provisions of [NCHRP 350](#), TL-[\_\_\_\_\_] or [AASHTO MASH](#), TL-[\_\_\_\_\_] . Submit a copy of the [FHWA Acceptance Letter](#).]

#### 2.1.4 Structural Steel H Section

Conform to [ASTM A709/A709M](#), Grade 50 or 50W. Galvanize posts, fuse plate and splice plate after fabrication in accordance with [ASTM A123/A123M](#).

##### 2.1.4.1 Slip Base, Fuse Plate and Splice Plate

Conform to [ASTM A36/A36M](#), minimum yield strength 50,000 psi.

#### 2.1.4.2 High-Strength Bolts, Nuts and Washers

High strength bolts must conform to [ASTM F3125/F3125M](#). Nuts must conform to [ASTM A563](#). Washers must conform to [ASTM F436/F436M](#). High strength bolts, nuts and washers must be zinc coated.

#### 2.1.5 Wood

Wood posts must be dry no. 1 grade Douglas fir, southern or Ponderosa pine, hemlock, spruce, or western larch conforming to [AASHTO M 168](#). Treat the posts with water-borne preservative according to [AASHTO M 133](#), [AWPA T1](#) and [AWPA U1](#).

### 2.2 FLAT ALUMINUM SIGN PANELS

Aluminum sign panels must conform to [ASTM B209](#), alloy-temper 6061-T6 or 5052-H38. The blanks must be free from laminations, blisters, open seams, pits, holes, other defects that may affect their appearance or use. The thickness must be uniform and the blank commercially flat.

### 2.3 EXTRUDED ALUMINUM SIGN PANELS

Conform to [ASTM B221](#), alloy 6063-T6. The maximum allowable deviation from flat on the face is 0.05 inches per foot. [Aluminum edge molding must be in accordance with [ASTM A320/A320M](#) or SAE J405d austenitic steel, minimum yield strength of 30,000 psi.]

### 2.4 TRAFFIC SIGN RETROREFLECTIVE SHEETING

All background sheeting applied to flat sheet and extruded panel signs must be in accordance with [ASTM D4956](#), Type III, IV, VII, VIII, IX or XI retroreflective sheeting and must have Class 1, 3, or 4 adhesive backing. Retroreflective sheeting must be high intensity that is an unmetallized micro prismatic reflective material.

Retroreflective sheeting must have sufficient adhesion, strength and flexibility such that the sheeting can be handled, processed and applied according to the manufacturer's recommendations without appreciable stretching, tearing, cracking or other damage.

#### 2.4.1 Legend and Border

Apply retroreflective sheeting as legend and border in accordance with [ASTM D4956](#), Type IX, XI, or [AASHTO M 268](#) Type C or D, Class 1. Retroreflective sheeting must be an unmetallized cube corner microprismatic reflective material. Retroreflective sheeting applied as legend and border for specific signing applications, without a datum mark on the surface of the sheeting, must be evaluated for rotational sensitivity in accordance with [AASHTO M 268](#), Section 3.3.1 and fabricated in accordance with [AASHTO M 268](#), Section 3.3.2.

#### 2.4.2 Screen Printed Transparent Colored Areas

For screen printed transparent colored areas or transparent colored overlay films on white sheeting, the coefficient of retroreflection (RA) must be no less than 70 percent of the original values for the corresponding color.



### 2.4.3 Adhesive Performance

Adhesive performance for retroreflective sheeting must be in accordance with [ASTM D4956](#). The sheeting surface must be in condition to be readily screen processed and compatible with transparent overlay films, plus recommended transparent and opaque screen process colors. Furnish manufacturer's information as to the type of solvent or solvents that may be used to clean the surface of the sheeting without detrimental loss of performance and durability.

### 2.5 LETTERS, NUMERALS, ARROWS, SYMBOLS, AND BORDERS

Apply letters, numerals, arrows, symbols, and borders on the retroreflective sheeting or opaque background of the sign using the direct or reverse screen process. Apply messages and borders of a color darker than the background to the paint or the retroreflective sheeting using the direct process. Messages and borders must be of a color lighter than the sign background and applied using the reverse screen process. Use opaque or transparent colors, inks, and paints of the type and quality recommended by the retroreflective sheeting manufacturer in the screen process. Perform the screening in a manner that results in a uniform color and tone, with sharply defined edges of legends and borders and without blemishes on the sign background that will affect intended use. Air dry or bake the signs after screening according to the manufacturer's recommendations to provide a smooth hard finish. Reject any signs with blister's or other blemishes.

### 2.6 DELINEATOR POSTS

#### 2.6.1 Steel Posts

Fabricate posts from steel conforming to [ASTM A36/A36M](#) or [ASTM A499](#) and having a minimum yield strength of 30 ksi and a minimum tensile strength of 50 ksi. Galvanize posts after punching in accordance with [ASTM A123/A123M](#).

#### 2.6.2 Flexible Posts

Provide [one-piece driveable] [or] [two-piece with driveable steel anchor] flexible posts. Posts must be impact-resistant, integrally colored UV stabilized polymer or polycarbonate extrusion or fiberglass reinforced composite material. Other materials are subject to approval by the Contracting Officer's Representative. Include a retroreflective sheeting plate with each post as indicated.

### 2.7 DELINEATOR RETROREFLECTORS

#### 2.7.1 Circular Prismatic Reflectors

Retroreflectors attached to steel posts must be a 3-inch minimum diameter acrylic plastic lens with prismatic optical elements and a smooth, clear, transparent face. Fabricate the back from similar material and fuse to the lens around the entire perimeter to form a homogeneous unit. Permanently seal the units against the intrusion of dust, water, or air. Mount the retroreflector unit in a housing fabricated from 0.063-inch aluminum alloy or similar, or from cold-rolled, hot dip, galvanized steel, having a thickness of 0.064 inches. Provide the indicated color.

#### 2.7.2 Retroreflective Sheeting

A retroreflective sheeting plate must be applied to each flexible post by the post manufacturer and must be in accordance with [ASTM D4956](#), Type III, IV, V, VII, VIII, IX or XI retroreflective sheeting. Retroreflective sheeting must be high intensity that is an unmetallized cube corner micro prismatic reflective material. Provide the size and color of the retroreflective sheeting plate as indicated.

## 2.8 HARDWARE

Bolts, nuts, post clips, lock and flat washers must be either aluminum alloy or commercial quality stainless steel, hot-dip galvanized or cadmium plated after fabrication. [Bolts/nuts must be an approved tamper resistant design.] Provide fiber washers of commercial quality.

## 2.9 CONCRETE

[ASTM C94/C94M](#), using  $3/4$  inch maximum aggregate, and having minimum compressive strength of 3000 psi at 28 days.

## PART 3 EXECUTION

### 3.1 SIGN POSTS

#### 3.1.1 [Steel Flanged Channel Section] [Perforated Square Steel Tube] [Round Steel Tube]

Sign posts consist of a base post and sign post. [Drive steel sign base posts with a suitable driving head. Attach sign posts to base posts. Replace any base posts damaged during driving or otherwise at no additional cost to the Government.] [Embed steel sign base posts in concrete as indicated.] [Install manufactured triangular slip bases in accordance with the manufacturer's instructions.]

#### 3.1.2 Structural Steel H Section Posts

Tighten all breakaway assembly bolts in a systematic manner to the prescribed torque indicated. Loosen each breakaway assembly bolt and re-tighten to the required torque in the same order as the initial tightening. Burr the threads at the nut using a center punch to prevent the nut from loosening. Tighten nuts on hinge plate bolts to the required minimum bolt tension values indicated.

#### 3.1.3 Wood

Drill holes in the post as indicated.

### 3.2 SIGN PANELS

Clean, degrease and etch the face of metal panels using methods recommended by the retroreflective sheeting manufacturer. After cleaning and degreasing, apply retroreflective sheeting material to the sign panels as recommended by the manufacturer. Perform shearing, cutting and punching prior to preparing the blanks for application of reflective material. Do not field drill holes in any part of the panel. Use nylon washers recommended by the sign sheeting manufacturer between the bolt heads and sign faces on flat sheet aluminum signs. Replace any damaged sign panels at no additional cost to the Government.

### 3.3 DELINEATORS

Drive steel delineator posts into the ground in a manner that will not damage the post. Attach flexible delineator posts to steel anchors [or drive into the soil in accordance with the manufacturer's instructions]. Demonstrate the method of installation for the Contracting Officer's Representative to verify that posts will be installed without being damaged.

### 3.4 LOCATION AND POSITION OF SIGNS

Locate and erect all signs in accordance with the drawings and MUTCD. Vertically mount signs at right angles to the direction of, and facing, the traffic that they are intended to serve. Where mirror reflection from the sign face is encountered to such a degree as to reduce legibility, turn the sign slightly away from the road. Turn signs that are placed 30 feet or more from the pavement edge toward the road. On curved alignments, determine the angle of placement by the direction of approaching traffic rather than by the roadway edge at the point where the sign is located. Mounted signs must present a smooth flat surface varying no more than 3/8 inch from a 4-foot straightedge placed in any position on the face of the sign after erection. Mount signs on traffic signal posts with strap or clamp type sign supports. Each installed sign will be inspected by the Contracting Officer's representative prior to acceptance by the Government.

-- End of Section --

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## SECTION 10 21 13

## TOILET COMPARTMENTS

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A336/A336M (2021) Standard Specification for Alloy Steel Forgings for Pressure and High-Temperature Parts

ASTM A385/A385M (2020) Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666 (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

ASTM B36/B36M (2018) Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar

ASTM B86 (2018; E 2021) Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B456 (2017) Standard Specification for Electrodeposited Coatings of Copper Plus

Nickel Plus Chromium and Nickel Plus Chromium

- ASTM D570 (1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
- ASTM D638 (2014) Standard Test Method for Tensile Properties of Plastics
- ASTM D696 (2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
- ASTM D2583 (2013a) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- ASTM D6386 (2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
- ASTM D7611/D7611M (2013; E 2014) Standard Practice for Coding Plastic Manufactured Articles for Resin Identification
- ASTM D7803 (2019) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating
- ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM G21 (2015; R 2021; E 2021) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

- CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

CSA GROUP (CSA)

- CSA B45.5-17/IAPMO Z124 (2017; Errata 2017; Errata 2018) Plastic Plumbing Fixtures

INTERNATIONAL CODE COUNCIL (ICC)

- ICC A117.1 (2017) Standard And Commentary Accessible and Usable Buildings and Facilities

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
	NSF INTERNATIONAL (NSF)
NSF/ANSI 51	(2012) Food Equipment Materials
	SCIENTIFIC CERTIFICATION SYSTEMS (SCS)
SCS	SCS Global Services (SCS) Indoor Advantage
	SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
SAE AMS2460	(2013; Rev A) Plating, Chromium
	U.S. GENERAL SERVICES ADMINISTRATION (GSA)
CID A-A-60003	(Basic; Notice 1) Partitions, Toilet, Complete
	U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines
	UNDERWRITERS LABORATORIES (UL)
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Fabrication Drawings

Installation Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

Cleaning and Maintenance Instructions

Colors And Finishes

Painted Metal

Sound-Deadening Cores

Anchoring Devices and Fasteners

## Hardware and Fittings

Brackets

Door Hardware

Toilet Enclosures

Room Entrance Screens

Urinal Screens

Pilaster Shoes

Finishes; G[, [\_\_\_\_\_]]

- [ Recycled content for painted steel partitions and screens; S]
- [ Recycled content for stainless steel partitions and screens; S]
- [ Recycled content for plastic laminate partitions and screens; S]
- [ Recycled content for solid phenolic partitions and screens; S]

## SD-04 Samples

Colors and Finishes; G[, [\_\_\_\_\_]]

Hardware and Fittings

Anchoring Devices and Fasteners

## SD-07 Certificates

Warranty

- [ Indoor air quality for plastic laminate clad partitions and screens; S]
- [ Indoor air quality for solid phenolic, black core partitions and screens; S]

## SD-10 Operation and Maintenance Data

Plastic Identification; G[, [\_\_\_\_\_]]

## 1.3 CERTIFICATIONS

## 1.3.1 Indoor Air Quality

## 1.3.1.1 Laminated Plastic and Solid Phenolic Products

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.



1.4 REGULATORY REQUIREMENTS

Comply with to ICC A117.1 code for access for the handicapped operation of toilet compartment door and hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's original unopened packages with the brand, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated; free from dust, water, other contaminants, and damage during delivery, storage, and construction.

1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for a period of [one year][\_\_\_\_] [years] from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

Provide a complete and usable toilet partition system, including toilet enclosures, room entrance screens, urinal screens, system of panels, hardware, and support components. Furnish the partition system from a single manufacturer, with a standard product as shown in the most recent catalog data. Submit Fabrication Drawings for toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory. Submit manufacturer's Cleaning and Maintenance Instructions in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

2.1.1 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D7611/D7611M. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

Type 1	Polyethylene Terephthalate (PET, PETE)
Type 2	High Density Polyethylene (HDPE)
Type 3	Vinyl (Polyvinyl Chloride or PVC)
Type 4	Low Density Polyethylene (LDPE)
Type 5	Polypropylene (PP)
Type 6	Polystyrene (PS)
Type 7	Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

2.2 MATERIALS

2.2.1 Painted Metal (Finish 1)

Provide galvanized steel sheet cold-rolled, stretcher-level, commercial quality material, conforming to [ASTM A653/A653M](#), with a Flame Spread Index of 0 and a Smoke Developed Index of 0. Surface preparation for painting to comply with [[ASTM D6386](#), method for baked enamel] [or] [[ASTM D7803](#) for powder coat].

2.2.2 Stainless Steel Sheet (Finish 2)

Provide stainless steel sheet conforming to [ASTM A666](#), 300 series commercial stainless steel sheet suitable for exposed applications with a Flame Spread Index of 0 and a Smoke Developed Index of 0. Provide smooth material, without creases or ripples. Provide face sheet of minimum of [0.048 inch](#) (([18 gauge](#)) thickness. Provide with [No. 4 finish] [manufacturer's standard textured finish] [\_\_\_\_\_].

2.2.3 Plastic Laminate Clad (Finish 3)

Provide decorative matte finish plastic laminate bonded to resin impregnated particle board core with non-toxic adhesive, with a Flame spread Index of 75 or less and a Smoked Developed Index of 450 or less.

2.2.4 Phenolic Core (Finish 4) (Finish 4A)

Provide compressed cellulose fibers impregnated with resins. Provide smooth material without creases or ripples, with a Flame Spread Index of 75 or less and a Smoke Developed Index of 450 or less. The surface laminate is fused to the resin-impregnated core.

2.2.5 Solid Polyethylene Panels (Finish 5)

Provide high density polyethylene (HDPE) suitable for exposed application. Waterproof, non-absorbent and graffiti resistant textured surface with a Flame Spread Index of 75 or less, and a Smoke Developed Index of 450 or less.

2.2.6 Homogenous Filled Acrylic (Finish 6)

Cast, 100 percent acrylic solid polymer material composed of acrylic polymer, mineral fillers, and pigments that meets the following minimum performance requirements.

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	<a href="#">4000 psi</a> (max.)	<a href="#">ASTM D638</a>
Hardness	55-Barcol Impressor (min.)	<a href="#">ASTM D2583</a>
Thermal Expansion	<a href="#">.000023 in/in/degrees F</a> (max.)	<a href="#">ASTM D696</a>
Boiling Water Surface Resistance	No Change	<a href="#">ANSI/NEMA LD 3</a>
High Temperature Resistance	No Change	<a href="#">ANSI/NEMA LD 3</a>
Impact Resistance (Ball Drop)		<a href="#">ANSI/NEMA LD 3</a>
<a href="#">1/4 inch</a> sheet	<a href="#">36 inches</a> , <a href="#">1/2 lb</a> ball, no failure	

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
1/2 inch sheet	140 inches, 1/2 lb ball, no failure	
3/4 inch sheet	200 inches, 1/2 lb ball, no failure	
Mold and Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.2.7 Sound-Deadening Cores

Provide sound deadening consisting of treated kraft paper honeycomb cores with a cell size of not more than 1 inch. Provide resin-material content weighing not less than 11 percent of the finished core weight. Face expanded cores on both sides with kraft paper.

2.2.8 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after fabrication, in conformance with ASTM A385/A385M and ASTM A123/A123M. Conceal all galvanized anchoring devices.

2.2.9 Brackets

Provide two-ear panel wall brackets, T-style, 1 inch stock. Provide stirrup style panel-to-pilaster brackets.

2.2.10 Hardware and Fittings

2.2.10.1 General Requirements

Provide hardware for the toilet partition system that complies with CID A-A-60003 for the specified type and style of partitions. Provide hardware finish highly resistant to alkalis, urine, and other common toilet room acids. Comply with 36 CFR 1191 of latching devices and hinges for handicap compartments; provide [chrome-plated steel] [ or ] [stainless steel] devices and hinges with door latches that operate without either tight grasping or twisting of the wrist of the operator. Submit three samples of each item, including anchoring devices and fasteners. Approved hardware samples may be installed in the work if properly identified.

Material	Conformance Standard

Cold-rolled sheet steel	ASTM A336/A336M, commercial quality
Zinc-base alloy	ASTM B86, Alloy AC41-A
Brass	ASTM B36/B36M, Alloy C26800
Aluminum	ASTM B221
Corrosion-resistant steel	ASTM A167, Type [302] [304]

#### 2.2.10.2 Finishes

- [ a. Provide chrome plating that complies with ASTM B456.
- ] [b. Provide finish that complies with SAE AMS2460, Class I, Type [I] [III].
- ] [c. Provide aluminum with clear anodic coating that complies with AA DAF45.
- ] [d. Provide corrosion-resistant steel with a No. 4 finish.
- ] [e. Provide stainless steel with a No. 4 finish.
- ] [f. Provide exposed fasteners that match the hardware and fittings.

#### ] 2.2.11 Door Hardware

##### 2.2.11.1 Hinges

Provide adjustable hinges to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors up to 10 degrees. Provide self-lubricating hinges with the indicated swing. Provide hinges that [are surface-mounted type] [are cutout-insert type] [are exposed pivot] [are semi-concealed] [and] [have the following type of return movement:

- [ a. Gravity return movement
- ] [b. Spring-action cam return movement
- ] [c. Torsion-rod return movement

##### ] 2.2.11.2 Latch and Pull

Provide latch and pull that is a combination rubber-faced door strike and keeper equipped with emergency access. [Provide [surface mounted] [concealed] latch].

##### 2.2.11.3 Coat Hooks

Provide coat hooks that are combination units with hooks and rubber tipped pins.

#### 2.3 PARTITION PANELS AND DOORS

Fabricate partition panels, and pilasters of materials and construction listed:

Provide [[painted metal partition] [stainless steel partition] panels and

doors in finished thickness of no less than 1 inch and pilasters no less than 1-1/4 inches, both with face sheets no less than [ 0.031 inch] [ 0.038 inch]]. [Phenolic partition panels not less than 1/2 inch thick and door and pilasters not less than 3/4 inch thick] [plastic laminated partition and door panels no less than [ 7/8 inch] [ 1 inch] thick and pilaster no less than 1 1/4 inch thick] [plastic (HDPE) partition panels, doors and pilasters not less than 1 inch thick] [homogenous filled acrylic partition panels and doors no less than 1/2 inch thick and pilasters no less than 1 inch thick].

[Provide painted metal toilet partitions and screens with recycled content of 27 percent minimum. Provide data identifying percentage of recycled content for painted steel partitions and screens. ] [Provide stainless steel toilet partitions and screens with recycled content of 50 percent minimum. Provide data identifying percentage of recycled content for stainless steel partitions and screens.] [Provide plastic laminate toilet partitions and screens with recycled content of 45 percent minimum. Provide data identifying percentage of recycled content for plastic laminate partitions and screens.] [Provide solid polyethylene toilet partitions and screens with recycled content of 30 percent minimum.]. [Provide homogeneous filled acrylic with recycled content of 6 percent minimum]. [Provide solid phenolic toilet partitions and screens with recycled content of 10 percent minimum]. [ Provide data identifying percentage of recycled content for solid phenolic partitions and screens.]

[ [Provide plastic laminate clad and solid phenolic, black core toilet partitions and urinal screens to meet the emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type)]. [Provide certification of indoor air quality for plastic laminate clad partitions and screens. ] [Provide certification of indoor air quality for solid phenolic, black core partitions and screens.]]

### 2.3.1 Toilet Enclosures

Provide toilet enclosures that comply with CID A-A-60003, Type I, Style [A, floor supported] [B, ceiling hung] [C, overhead braced] [F, overhead braced-alcove]. Furnish width, length, and height of toilet enclosures as shown. Finish surface of panels are [painted metal (Finish 1)] [stainless steel (Finish 2)] [plastic laminate clad (Finish 3)] [solid phenolic, black core (Finish 4)] [solid phenolic, color through the core (Finish 4A)] [solid polyethylene (Finish 5)] [homogenous filled acrylic (Finish 6)] [\_\_\_\_\_]; water resistant; graffiti resistant; non-absorbent radius beveled edges. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required, and provide cut outs for through partition toilet accessories. Provide grab bars to withstand a bending stress, shear stress, shear force, and a tensile force induced by 250 lbf. Grab bars cannot rotate within their fittings.

### 2.3.2 Room Entrance Screens

Provide room entrance screens that comply with CID A-A-60003, Type II, Style [A, floor anchored] [B, ceiling hung braced] [C, overhead braced] [D, wall hung] [\_\_\_\_\_]. Provide finish surface of screens to be [painted metal (Finish 1)] [stainless steel (Finish 2)] [plastic laminate clad (Finish 3)] [solid phenolic, black core (Finish 4)] [solid phenolic, color through the core (Finish 4A)] [solid polyethylene (Finish 5)] [homogenous filled acrylic (Finish 6)] [\_\_\_\_\_]; water resistant; graffiti resistant; non-absorbent with radius beveled edges. Furnish length and height of

screens as shown. Provide thickness to match toilet compartment panel construction. Fabricate screens from the same types of panels, pilasters, and fittings as the toilet partitions.

### 2.3.3 Urinal Screens

Provide urinal screens that comply with [CID A-A-60003](#), Type III, Style [A, floor supported] [B, ceiling hung] [C, overhead braced] [D, floor to ceiling hung] [E, floor to ceiling post supported] [F, wall hung]. Provide finish for surface of screens as [painted metal (Finish 1)] [stainless steel (Finish 2)] [plastic laminate clad (Finish 3)] [solid phenolic, black core (Finish 4)] [solid phenolic, color through the core (Finish 4A)] [solid polyethylene (Finish 5)] [homogenous filled acrylic (Finish 6)] [\_\_\_\_\_]; water resistant; graffiti resistant; non-absorbent with radius beveled edges; with manufacturer's standard post design of materials matching the thickness and construction of pilasters. Furnish width and height of urinal screens as shown. Provide thickness to match toilet compartment panel construction. Secure wall hung urinal screens with [a minimum of three wall stirrup brackets.] [42 inches long, continuous flanges.] Fabricate screens from the same types of panels and pilasters as the toilet partitions. Use corrosion-resistant steel fittings and fasteners.

## 2.4 CEILING-HUNG PARTITIONS

Provide pilasters in size indicated that are manufacturer's standard corrosion resistant anchoring assemblies complete with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Design anchoring device to transmit the strain and loading on the pilaster directly to the structural support above without putting strain or loading on the finished ceiling. Provide sleeves or caps at tops of pilasters to conceal anchorage.

## 2.5 FLOOR-ANCHORED PARTITIONS

Provide pilasters in size indicated that are manufacturer's standard corrosion resistant anchoring assemblies complete with leveling adjustment nuts and pilasters for structural connection to floor. Provide anchoring device at the bottom of the pilaster consisting of a steel bar not less than  $1/2$  by  $7/8$  inch welded to the reinforced face sheets and having not less than two  $3/8$  inch round anchorage devices for securing to the floor slab. Provide anchorage devices complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Provide shoes at pilasters to conceal anchorage.

## 2.6 OVERHEAD-BRACED PARTITIONS

Provide pilasters in sizes indicated that are manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism. Provide anchoring device at the bottom of the pilaster consisting of a channel-shaped floor stirrup fabricated from not less than  $0.0635$  inch thick material and a leveling bolt. Secure the stirrup to the pilaster with not less than a  $3/16$  inch bolt and nut after the pilaster is leveled. Secure the stirrup to the floor with not less than two lead expansion shields and sheetmetal screws. Fabricate overhead brace from a continuous extruded aluminum tube not less than  $1$  inch wide by  $1-1/2$  inch high,  $0.125$  inch wall thickness. Finish is AA-C22A31 in accordance with [AA DAF45](#). Set and secure brace into the top of each pilaster. Provide shoes at pilasters to conceal supports and leveling

mechanism.

## 2.7 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Provide [aluminum] [stainless steel] [one piece molded HDPE] [\_\_\_\_\_] pilaster shoes. Height is a minimum 3 inches.

## 2.8 HARDWARE

Provide hardware for the toilet partition system that complies with CID A-A-60003 for the specified type and style of partitions. [Provide hardware pre-drilled by manufacturer.] Use a hardware finish that is highly resistant to alkalis, urine, and other common toilet room acids. [Hardware includes: chrome plated nonferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; [black anodized] [chrome plated] [\_\_\_\_\_] aluminum door latch; door strike and keeper with rubber bumper; and cast alloy chrome plated coat hook and bumper, [\_\_\_\_\_] .] Provide latching devices and hinges for handicap compartments complying with 36 CFR 1191 and [chrome-plated steel] [or] [stainless steel] door latches that operate without either tight grasping or twisting of the wrist of the operator. [ Use stainless steel, tamper proof type screws and bolts. Wall mounting brackets are continuous, full height, [aluminum] [stainless steel] [heavy duty plastic] [\_\_\_\_\_] , in accordance with toilet compartment manufacturer's instructions.. Provide floor-mounted anchorage consisting of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.]

## 2.9 COLORS AND FINISHES

### 2.9.1 Colors

Provide color [as specified in Section 09 06 00 SCHEDULES FOR FINISHES.] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.]

[Color of pilaster shoes matches the core of solid plastic compartments and screens.] Submit three samples showing color and a finished edge on two adjacent sides and core construction, each not less than 12 inch square.

### 2.9.2 Finishes

#### 2.9.2.1 Finishes No. 1 Through No. 3

Provide partitions, panels, screen, and door finishes that comply with CID A-A-60003 finished with [Painted Metal (Finish 1)] [Stainless Steel (Finish 2)] [Plastic Laminate Clad (Finish 3)].

#### 2.9.2.2 Finishes No. 4, No 4A and No. 5

Provide manufacturer's standard [black core (Finish 4)] [color through the core (Finish 4A)] [or] [solid polyethylene (Finish 5)] formed under high pressure rendering a single component section not less than 1 inch thick. Colors extend throughout the panel thickness.

#### 2.9.2.3 Finish No. 6

Provide homogeneous filled acrylic (Finish 6) with through body colors

meeting [CSA B45.5-17/IAPMO Z124](#).

## PART 3 EXECUTION

### 3.1 PREPARATION

Take field measurements prior to the preparation of drawing and fabrication to ensure proper fits. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work. Verify correct spacing of plumbing fixtures. Verify correct location of built in framing, anchorage, and bracing. Report in writing to Contracting Officer prevailing conditions that adversely affect satisfactory execution of the work of this section. Do not proceed with work until unsatisfactory conditions have been corrected.

### 3.2 METAL PARTITION FABRICATION

- a. Fabricate metal partition panels, doors, screens, and pilasters required for the project from galvanized-steel face sheets with formed edges. Laminate face sheets via pressure to the sound-deadening core with edges sealed with a continuous locking strip and corners mitered and welded. Ground all welds smooth. Provide concealed reinforcement for installation of hardware, fittings, and accessories. Surface of face sheets must be , free from wave, warp, or buckle.
- b. Before application of an enamel coating system, solvent-clean galvanized-steel surfaces to remove processing compounds, oils, and other contaminants harmful to coating-system adhesion. After cleaning, coat the surfaces with a metal-pretreatment phosphate coating. After pretreatment, finish exposed galvanized-steel surfaces with a baked-enamel coating system as specified.
- c. Provide an enamel coating system consisting of a factory-applied baked acrylic enamel coating system. Provide a coating system that is a durable, washable, stain-resistant, and mar-resistant finish.

### 3.3 INSTALLATION

Do not install items that show visual evidence of biological growth. Install partitions rigid, straight, plumb, and level, with the panels centered between the fixtures. Provide a panel clearance of not more than [1/2 inch](#) and secure the panels to walls and pilasters with continuous full height wall brackets. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints. Secure panels to pilasters with brackets matching the wall brackets. Provide for adjustment due to minor floor variations. Locate head rail joints at pilaster center lines. Install adjacent components for consistency of line and plane. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors.

- a. Secure panels to hollow plastered walls with toggle bolts using not less than [1/4-20](#) screws of the length required for the wall thickness. Provide toggle bolts with a load-carrying strength of not less than [600 pounds](#) per anchor.
- b. Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than [1/4-20](#) screws of the length required for the wall thickness. Provide toggle bolts with a load-carrying strength of not less than [600 pounds](#) per



anchor.

- c. Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with not less than 1/4-20 screws, with a shield length of not less than 1-1/2 inches. Provide expansion shields with a load-carrying strength of not less than 600 pounds per anchor.
- d. Submit [Installation Drawings](#) for toilet partitions, room entrance screens, and urinal screens showing plans, elevations, details of construction, hardware, reinforcing and blocking, fittings, mountings and escutcheons. Indicate on drawings the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

### 3.4 CEILING-HUNG PARTITIONS

Secure pilasters to the structural support above with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level the bottoms of doors with bottoms of pilasters when doors are in a closed position.

### 3.5 FLOOR-ANCHORED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level tops of doors with tops of pilasters when doors are in a closed position. Expansion shields have a minimum 2 inch penetration into the concrete slab.

### 3.6 OVERHEAD-BRACED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Secure overhead brace to the pilaster face with not less than two fasteners per face. Expansion shields have a minimum 2 inch penetration into the concrete slab. Make tops of doors parallel with the overhead brace when doors are in a closed position.

### 3.7 FINAL ADJUSTMENT

After completion of the installation, make final adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly. Doors have a uniform vertical edge clearance of approximately 3/16 inch and rest open at approximately 30 degrees when unlatched.

### 3.8 CLEANING

Touch up baked enamel and powder coat finish with the same color of paint that was used for the finish. Clean all surfaces and adjacent surfaces soiled as a result of the work, in an approved manner compliant with the manufacturer's recommended cleaning and protection from damage procedures until accepted. Remove all equipment, tools, surplus materials, and work debris from the site.

-- End of Section --

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## SECTION 10 22 13

## WIRE MESH PARTITIONS

08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3

(2002; Suppl 2001-2004; R 2008)  
Cold-Formed Steel Design Manual Set

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M

(2019) Standard Specification for Carbon  
Structural Steel

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Wire Mesh Partitions

Show layout, details, materials, dimensions, finishes, and all information necessary for fabrication and installation.

## SD-03 Product Data

## Wire Mesh Partitions

Submit for each type of partition, door, and window.

[ Recycled Content for Metal Post and Framing Materials; S

] [ Recycled Content for Wire Materials; S

## ] 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original, unopened containers or packaging with labels intact and legible. Deliver, store, and handle materials so as to prevent damage. Replace damaged or defective materials with new.

## 1.4 DESCRIPTION OF WORK

Wire mesh partitions must be [all wire type] [sheet metal base type], [normal duty for normal industrial use] [heavy duty for extra heavy industrial use]. Provide partitions complete with fasteners, capping bars, adjustable floor sockets, bracing, doors, [service windows,] hardware, and other items necessary for a complete, useable, and rigid installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

[ Metal post and framing materials listed below must contain a minimum of [15] [\_\_\_\_\_] percent post-consumer recycled content and wire materials must contain a minimum of [50] [\_\_\_\_\_] percent post-industrial recycled content. Provide data identifying percentage of recycled content for metal post and framing materials. Also provide data identifying percentage of recycled content for wire materials.

#### ]2.1.1 Steel Shapes, Plates, and Bars

ASTM A36/A36M.

#### 2.1.2 Cold-Formed Steel

AISI SG03-3.

#### 2.1.3 Wire Mesh

Carbon steel wire, woven diamond mesh, intermediate crimped.

#### 2.1.4 Floor Sockets

Cast or forged steel or ductile iron, adjustable, approximately 2-1/2 inches high.

### 2.2 NORMAL DUTY PARTITIONS

#### 2.2.1 Wire Mesh

10 gage wire, 1-1/2 inch mesh.

#### 2.2.2 Vertical Frames

1-1/4 by 5/8 inch cold-rolled C section channels or 1-1/4 by 5/8 by 1/8 inch channels.[ Provide only C channels where frames are installed toe to toe without posts.]

#### 2.2.3 Horizontal Frames

1 by 5/8 inch channels.

#### 2.2.4 Center Reinforcing Bar

One 1 by 1/2 by 1/8 inch channel with all wires woven through, or two 1 by 3/8 by 1/8 inch channels bolted together with mesh in between.

#### 2.2.5 Capping Bar

2-1/4 by one by 1/8 inch channel or 2 by 1/4 inch flat bar.

## 2.2.6 Corner Posts

Structural steel angles, 1-1/4 by 1-1/4 by 1/8 inch.

## 2.2.7 Line Posts

Unless otherwise indicated, provide partitions more than 12 feet high with flat bar line posts bolted between vertical frame channels. Sizes of posts must be as follows:

Partition Height	Size of Posts
12 feet to 14 feet 8 inches	1-3/4 by 5/16 inch or 2 by 1/4 inch
14 feet 8 inches to 19 feet 8 inches	2-1/2 by 5/16 inch
19 feet 8 inches to 23 feet 8 inches	3 by 5/16 inch

## 2.2.8 Hinged Doors

Frames must be 1-1/4 by 1/2 by 1/8 inch channels with 1-1/4 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-3/8 by 3/4 by 1/8 inch angle riveted to the lock stile. Provide 1 1/2 pairs of regular weight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

## 2.2.9 Sheet Metal Base

Hot- or cold-rolled sheet steel, not lighter than 16 gage.

## 2.3 HEAVY DUTY PARTITIONS

## 2.3.1 Wire Mesh

6 gage wire, 2 inch mesh.

## 2.3.2 Panel Frames

1-1/2 by 3/4 by 1/8 inch steel channels.

## 2.3.3 Center Reinforcing Bar

One 1-1/2 by 3/4 by 1/8 inch channel with all wires woven through, or two 1-1/4 by 3/8 by 1/8 inch channels bolted together with mesh in between.

## 2.3.4 Capping Bar

Structural steel channel, 3 inch by 4.1 pounds.

## 2.3.5 Corner Posts

Structural steel angles, 1-3/4 by 1-3/4 by 1/8 inch.

## 2.3.6 Line Posts

Unless otherwise indicated, provide partitions with flat bar line posts bolted between vertical frame channels. Sizes of posts must be as follows:

Partition Height	Size of Posts
7 feet to 12 feet	2-1/2 by 5/16 inch
12 feet to 16 feet	3 by 5/16 inch or 2-1/2 by 3/8 inch
16 feet to 20 feet	3-1/2 by 5/16 inch

### 2.3.7 Hinged Doors

Frames must be 1-1/2 by 3/4 by 1/8 inch channels with 1-1/2 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-5/8 by 7/8 by 1/8 inch angle riveted to the lock stile. Provide 1-1/2 pairs of heavyweight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

### 2.4 SLIDING DOORS

Frames must be 1-1/2 by 3/4 by 1/8 inch channels with 1-1/2 by 1/8 inch flat bar cover all around. Provide two four-wheel, roller bearing hangers and steel box track for each door.

### 2.5 DOOR OPENING FRAMES

Provide frames the same size and shape as the vertical frames for the mesh panels.

### 2.6 LOCKS

Provide each door with a mortise type lock with a six-pin tumbler lock cylinder on the outside and a recessed knob on the inside.

### 2.7 SERVICE WINDOWS

Slide up type, mounted in standard mesh panel reinforced with channel tracks. Opening must be 24 inches wide by 15 inches high unless otherwise indicated. Provide two spring loaded latches, operable only from the inside, to lock window in open and closed positions. [Form shelf of 12 gage sheet steel, 12 inches deep by 25 inches wide, unless otherwise indicated.]

### 2.8 FABRICATION

#### 2.8.1 Standard Panels

Wire must be woven into diamond mesh, intermediate crimped, and securely clinched to frames. Joints must be mortised and tenoned. Wire must be continuous at center reinforcing bars, either woven through a single channel or bolted between two channels. Panel vertical frames must have [ 1/4 inch bolt holes 12 inches o.c. for normal duty partitions] [3/8 inch bolt holes 18 inches o.c. for heavy duty partitions].

#### 2.8.2 Sheet Metal Base Panels

Upper portion must be as specified for standard panels, except that the wire must be clinched into the center reinforcing bar. Form sheet steel to fit between the panel frames and securely bolt to the frames.

### 2.8.3 Doors [and Service Windows]

Construction must be similar to that specified for panels. Wire mesh must be the same as that used in the adjacent partition panels.

### 2.8.4 Finish

Thoroughly clean ferrous metal, treat with phosphate, and paint with [green] [black] [gray] enamel in the shop.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Wire Mesh Partitions

Install plumb, level, and true to line, within a tolerance of 1/8 inch in 10 feet or the height or run of the partition, if less than 10 feet. Anchor floor sockets to the floor with expansion bolts. Bolt vertical frames and posts together with [1/4 inch bolts 12 inches o.c. for normal duty partitions] [3/8 inch bolts 18 inches o.c. for heavy duty partitions]. Secure top frames to a continuous capping bar with 1/4 inch diameter U bolts not more than 28 inches o.c.

#### 3.1.2 Doors [and Service Windows]

Install in accordance with the manufacturers' recommendations. Adjust as required so that doors [, windows,] and hardware operate freely and properly.

#### 3.1.3 Bracing

Brace free standing partitions more than 20 feet in length, at intervals not greater than 20 feet [with a steel channel brace connected to the capping bar and anchored to the building wall or framing member] [with a structural steel I section or tube post welded to a 9 by 9 inch steel base plate anchored to the floor with 4 expansion bolts] [or as indicated].

#### 3.1.4 Touch-Up

Clean and paint scratches, abrasions, and other damage to shop painted surfaces to match the shop-applied finish.

Repair minor surface rust areas. Clean and prime with rust inhibitive primer paint. Apply final paint to match shop-applied finishes.

-- End of Section --

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## SECTION 10 22 19

## DEMOUNTABLE AND MOVABLE PARTITIONS

08/17, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## ASTM INTERNATIONAL (ASTM)

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

ASTM C1396/C1396M (2017) Standard Specification for Gypsum Board

ASTM E72 (2015) Conducting Strength Tests of Panels for Building Construction

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E90 (2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E413 (2022) Classification for Rating Sound Insulation

## BIFMA INTERNATIONAL (BIFMA)

ANSI/BIFMA X5.6 (2016) American National Standards For Office Furnishings -Panel Systems

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022)  
National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 183 (2009) UL Standard for Safety Manufactured Wiring Systems

UL 2818 (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

SD-03 Product Data

Warranty; G[, [\_\_\_\_]]

Partition System; G[, [\_\_\_\_]]

[ Recycled content for gypsum board; S]

[ Recycled content for paper facing; S]

[ Recycled content for gypsum cores; S]

SD-04 Samples

Partition System Samples; G[, [\_\_\_\_]]

Mock-Up; G[, [\_\_\_\_]]

### SD-07 Certificates

Burning Characteristics

Acoustical Performance

Structural Performance

Indoor air quality for gypsum board; S

Indoor air quality for aerosol adhesives; S

### SD-10 Operation and Maintenance Data

Assembly Manuals; G[, [\_\_\_\_]]

Maintenance Manuals; G[, [\_\_\_\_]]

## 1.3 CERTIFICATIONS

### 1.3.1 Indoor Air Quality Certifications

#### 1.3.1.1 Gypsum Wall Systems

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.

#### 1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

## 1.4 QUALITY ASSURANCE

Manufacturer must have a minimum of [10] [\_\_\_\_] years of documented successful experience in designing and manufacturing partitions conforming to the requirements in this section. Provide product from a single manufacturer.

Partition installer must have a minimum of [5] [\_\_\_\_] years of documented successful experience in the installation of partitions similar to the requirements in this section. When required by the manufacturer, partitions must be installed by an authorized dealer with a certified installation crew.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to project site in accordance with manufacturer's

instructions in original unopened and undamaged packages. Store in a clean, dry, and secure place free from damage during construction activities. Packages must contain labels indicating the manufacturer's name, brand name, size, finish and placement location.

#### 1.6 PROJECT/SITE CONDITIONS

Temperature and humidity conditions within the area to receive partitions must be maintained as close as possible to the final occupancy standards. Maintain a minimum of 60 degrees F and a relative humidity level of no higher than 70% continuously. Do not begin installation until the building envelope provides complete protection from the weather.

#### 1.7 WARRANTY

Warrant the partition system for a period of [10] [\_\_\_\_\_] years, and warrant fabrics and other covering materials for 3 years. Warranties must be signed by the authorized representative of the manufacturer. Warranties accompanied by document authenticating the signer as an authorized representative of the guarantor must be presented to the Contracting Officer upon the completion of the project. Guarantee that the partition system and installation are free from any defects in material and workmanship from the date of delivery.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

##### 2.1.1 Burning Characteristics

Submit certification attesting that partition system has a Class A (under 25) Flame Spread Rating in conformance with ASTM E84.

##### 2.1.2 Acoustical Performance

Submit certification attesting that sound-rated partition assemblies have a minimum Sound Transmission Coefficient (STC) of [[36] [42] [44] [\_\_\_\_\_] for solid panel] [[30] [\_\_\_\_\_] for glass panel]. Determine STC range in accordance with Sound Transmission Test by Two-Room Method and reported in accordance with ASTM E90 and ASTM E413 for frequency data. Tested assembly must have been assembled in the same manner that the partitions will be installed on the project.

##### 2.1.3 Structural Performance

Submit test results from an independent laboratory certifying the following results.

###### 2.1.3.1 Transverse-Load Capacity

Provide partitions capable of [sustaining 5 psf minimum transverse load] [supporting furniture systems components] with lateral panel deflection no greater than [[1/120] [1/240] for solid panel] [1/175 for glass panel] when tested in accordance with ASTM E72.

###### 2.1.3.2 Load-Bearing Capability

Provide proof load of not less than [ 300 lb concentrated] [ 3.2 lb/linear inch distributed] [\_\_\_\_\_] when tested according to ANSI/BIFMA X5.6.

### 2.1.3.3 Non-Load Bearing Capability

Wall system is designed for non-load bearing capability.

### 2.1.4 Electrical and Communication Capability

Electrical components, devices, systems and accessories must meet requirements of **NFPA 70**. Provide a partition system that accommodates electrical switches, outlets, voice/data cabling and jacks, and other components [at multiple heights in the panel] within the internal panel cavity. Surface mounted components will not be accepted. Provide [standard] [\_\_\_\_\_] size light switch boxes, electrical boxes, double gang outlet boxes for voice/data jacks, switches, outlets, faceplates, and conduit at mounting heights and locations as indicated on the electrical drawings. Coordinate finish of switches, outlets, and faceplates with building and other other componentry finishes. [Factory install all electrical components and accessories for partitions. Panels with factory installed electrical wiring must be UL listed or labeled and meet the requirements of **UL 183**. The label or listing of Underwriter's Laboratories, Inc. will be accepted as evidence that the material or equipment conforms to the applicable standards, and must be marked for intended use. In lieu of this label or listing, submit a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with the required procedures of UL and that the material and equipment comply with contract requirements.] Building electrical power will be [ceiling] [wall] [base] [access floor] [\_\_\_\_\_] fed. Coordinate the building and partition system electrical power. Electrical work must conform to the requirements of Section **26 20 00 INTERIOR DISTRIBUTION SYSTEM**.

## 2.2 PARTITION SYSTEM

Provide a **partition system** consisting of a series of individual, floor-supported, [[floor-to-ceiling] [partial height]] [[site assembled] [factory assembled]] panels as shown. [Provide a system that is non-progressive, allowing for removal and re-installation of panels, including door frames, at any position, without disturbing adjacent panels]. Provide panel faces that are removable, reusable, and attached to the panel frame without the use of screws or other mechanical fasteners. Provide a top channel that holds panels in place and accommodates floor-to-ceiling variations. System must be capable of attaching to multiple standard ceiling types in a non-marring manner. Provide floor attachment without mechanical fastening. Installation, modifications, and removal of the system must not damage adjacent building surfaces and elements, including floors, walls, ceilings, columns and window mullions. All system connectors to fixed building components must be removable, and reusable, and non-marring. Solid panels must be capable of field cutting to accommodate variations in floor and ceiling levels, end filler conditions, and other existing building conditions. The partition system must be complete with accessories to meet performance requirements.

Construct a **Mock-up** on site minimum **8 x 8 foot** [\_\_\_\_\_] in size for each color and type of panel specified after finish samples are approved, and prior to installation of partitions. Show partition construction and method of attachment to walls, floor, and ceiling. Review of the mock-up may result in adjustments to the product, layout and finishes. Once approved, use the mock-up as a standard of workmanship within the facility. Remove mock-ups when directed. Approved mock-ups may become

part of the completed work if approved by the Contracting Officer.

Submit product data for [partition system](#), to include catalog cuts, brochures, product information, and other necessary literature to indicate compliance with specifications.

## 2.3 MATERIALS AND COMPONENTS

### 2.3.1 Panels

Provide panel faces constructed of [steel] [gypsum board [minimum [1/2 inch](#)] [\_\_\_\_\_] thick conforming to [ASTM C1396/C1396M](#), gypsum backing board conforming to [ASTM C1396/C1396M](#)] [wood composite] [fiber composite]. Include panels with [tongue-and-groove] [panel clips] [panel connectors] at joints to align panels. Provide concealed integrated slots to mount furniture components, accessories and equipment at multiple elevations. Maximum total load for bracket supports on one or both wall surfaces must not exceed [1240 lb](#). Provide panels that are manufacturer's standard construction with fillers and bracing as required. Provide panel thickness of minimum[ [2 1/4 inch](#)] [ [3 1/2 inches](#)] [ [4 inches](#)] [\_\_\_\_\_] . [Provide panel face thickness of minimum[ [1/2 inch](#)] [\_\_\_\_\_] .] Submit three sets of [Assembly Manuals](#) describing assembly and reconfiguration procedures.

[Provide gypsum board with a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. Provide data identifying percentage of [recycled content for gypsum board](#).] [Provide gypsum products with paper facings that contain a minimum of 100 percent post-consumer recycled paper content. Provide data identifying percentage of [recycled content for paper facing](#).] [Provide gypsum cores containing a minimum of 95 percent post-industrial recycled gypsum content. Provide data identifying percentage of [recycled content for gypsum cores](#).]

Provide gypsum wall board and panels that the emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type). Provide certification or validation of [indoor air quality for gypsum board](#).

#### 2.3.1.1 Adhesives

Provide sealants and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of [CDPH SECTION 01350](#) (use the office or classroom requirements, regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#) or [GS-36](#). Provide certification or validation of [indoor air quality for aerosol adhesives](#) used on the interior of the building (inside of the weatherproofing system).

#### 2.3.2 Framing System

Provide framing system that consists of extruded aluminum or roll-formed steel components which include ceiling runners, floor track, [studs or posts,] bracing, and suitable treated fasteners to prevent corrosion. Provide a rigid, stable partition system when the frame is assembled with the panels.

#### 2.3.3 Glass and Glazing

Provide glass and glazing for partitions that are fully contained within

the partition system and in locations as shown on the drawings. Provide [tempered] [laminated] glass that is [clear] [patterned] and complies with ANSI Z97.1 and ASTM C1048. [Provide [wood] [metal] mullions (muntins).] [All glass must be factory installed.] No protruding glazing beads or removable stops will be visible. [Provide glass and glazing in accordance with Section 08 81 00 GLAZING.]

#### 2.3.4 Doors and Frames

Provide demountable partitions complete with [[single] [double]] [[sliding] [butt-hinged] [pivot-hinged]] doors and frames as shown on the drawings. Provide doors and frames that are fully contained with the panels and use standard panel connection methods. Provide 1-3/4 inch thick flush type [hollow metal] [solid core] [wood veneer] [plastic laminate] [[tempered] [laminated] glass slab] [[tempered] [laminated] combination glass with [[wood]] [\_\_\_\_\_]] doors of manufacturer's standard construction. Door frames must be compatible in appearance with other trim components and allow for variations in floor level. [Provide doors in accordance with Section 08 14 16 FLUSH WOOD DOORS.]

#### 2.3.5 Door Hardware

Door hardware to be [supplied and installed by partition manufacturer] [supplied by others and installed by partition manufacturer] [\_\_\_\_\_]. Provide hardware for doors in accordance with Section 08 71 00 DOOR HARDWARE. Provide hardware cutouts and reinforcement as required in doors and frames for hardware furnished.

#### 2.3.6 Glazing Frames

Assemble glazing frames from minimum 0.065 inch thick extruded anodized aluminum parts or minimum 0.0478 inch cold-rolled steel and vinyl components. Indicate sizes and configurations of glazed openings on the drawings.

#### 2.3.7 Trim

Provide [base] [ceiling] [panel] trim without exposed fasteners nominal [ 4 inch] [\_\_\_\_\_] high, with [recessed] [projected] [flush] [\_\_\_\_\_] profile.

### 2.4 FINISHES

Provide panel finish of [factory-applied powder coat steel] [factory applied vinyl wallcovering finish, Type II (Medium Duty), UL Class A conforming to ASTM E84] [fabric] [tackable fabric] [high pressure laminate] [wood veneer] [factory primed gypsum board for field paint] [factory painted gypsum board] [tackable wallboard] [magnetic marker board] [marker board] [back painted glass] [\_\_\_\_\_]. Provide exposed metal trim finish of [aluminum [satin clear] [[light] [medium] [dark] bronze]] [[factory-applied powder coat] [factory primed for field paint] [steel] [\_\_\_\_\_]]. Non-metal panel trim to [match panel] [match exposed trim] [\_\_\_\_\_]. Non-metal base and ceiling trim to [match exposed trim] [match panel] [\_\_\_\_\_]. Provide [factory primed for field paint] [factory-applied powder coat] [wood veneer] [plastic laminate] [\_\_\_\_\_] doors. Painting must conform to the requirements of Section 09 90 00 PAINTS AND COATINGS. Provide color of all partition component finishes [in accordance with Section 09 06 00 SCHEDULE FOR FINISHES] [as indicated on the drawings] [\_\_\_\_\_]. Submit all exposed [Partition System Samples](#) to include panel and component finishes and electrical components such as faceplates. Samples must be actual samples

and a minimum of 3 by 3 inches in size.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Verify field dimensions before fabrication of partition system and record on installation drawings. Coordinate fabrication and installation schedule with construction schedule to avoid delay in the work. Examine and verify that site conditions are in agreement with the design package and manufacturer's requirements.

#### 3.2 PREPARATION

Verify floor and ceiling dimensions in accordance with approved shop drawings prior to starting the work. Floor under partitions must be level to within 1/8 inch in 10 feet, non-accumulative. Correct conditions which may adversely affect the partition installation before installing partitions. Finishing operations, such as painting, carpeting, and ceiling grid installation, must be completed prior to partition installation.

#### 3.3 INSTALLATION

Do not install items that show visual evidence of biological growth. Install partitions using certified installers in accordance with manufacturer's recommended installation instructions. Install partitions in conformance with details in the drawings and approved installation drawings. Assemble and erect the system with the least possible drilling and cutting of existing construction. Provide a complete partition installation with accessories to meet specified requirements and the capability of disassembly by means of ordinary tools. Provide concealed fastening devices and pressure-fit components that will not mar the floor, wall and ceiling surfaces and are free of exposed screws, nuts, rivets or bolts. Install panels rigid, straight and plumb, with horizontal lines level and aligned. Provide a complete installation with continuous light and sound seals at connections to ceilings, floors, fixed walls and abutting surfaces. Coordinate the partition system installation with the work of other trades that are affected. Provide dimensions on drawings verifying conformance to life safety code and electrical switch, outlet, infeed and jumper placements.

##### 3.3.1 Doors and Windows

Hang doors to [swing] [slide] freely and fit hardware precisely. Install glass for glazed openings on shims in a vinyl or polyurethane foam gasket. Install glass stops without exposed fastenings.

##### 3.3.2 Trim

Install trim in accordance with manufacturer's recommendations. [For site assembled partitions install wall base in the longest lengths possible. Joints must be fitted tight. Miter internal corners and scribe base to fit to door frames and other obstructions.] [Provide partition base covers that snap on.] Base must tightly adhere to wall surfaces.

#### 3.4 ADJUSTMENTS

Repair or replace damaged partition finishes and components and damaged



floor, wall and ceiling finishes to the original conditions.

### 3.5 CLEANING

Upon completion of installation, clean partition components and finishes in accordance with partition manufacturer's recommendations. Do not use alkaline or abrasive agents. Avoid scratching or marring partition finish surfaces. Submit three sets of [Maintenance Manuals](#) describing proper cleaning and minor repair procedures.

### 3.6 PROTECTION

Protect partitions from damage through the duration of construction activities.

-- End of Section --

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## SECTION 10 26 00

## WALL AND DOOR PROTECTION

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## ASTM INTERNATIONAL (ASTM)

ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM B221 (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM D256 (2010; R 2018) Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

ASTM D543 (2020) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents

ASTM D635 (2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM F476 (2014) Standard Test Methods for Security of Swinging Door Assemblies

ASTM G21 (2015; R 2021; E 2021) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2022) Standard for Fire Doors and Other  
Opening Protectives

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545 (2005; R 2021) Instrumental Color  
Difference Measurement for Exterior  
Finishes, Textiles and Colored Trim

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program  
For Chemical Emissions For Building  
Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Corner Guards; G[, [\_\_\_\_\_]]

Wall Guards; G[, [\_\_\_\_\_]]

Door Protectors; G[, [\_\_\_\_\_]]

Wall Covering and Panels; G[, [\_\_\_\_\_]]

### SD-03 Product Data

Corner Guards; G[, [\_\_\_\_\_]]

Wall Guards; G[, [\_\_\_\_\_]]

Door Protectors; G[, [\_\_\_\_\_]]

Wall Covering and Panels; G[, [\_\_\_\_\_]]

- [ Recycled content for aluminum component of corner guards; S
- ][ Recycled content for steel component of corner guards; S
- ][ Recycled content for aluminum component of wall guards, Combination Handrail/Wall guard and handrails; S
- ][ Recycled content for aluminum component of crash rail/bed locators; S
- ][ Recycled content for aluminum component of combination handrail/crash rail; S
- ][ Recycled content for aluminum component of handrails; S

] SD-04 Samples

Corner Guards; G[, [\_\_\_\_\_]]

Wall Guards; G[, [\_\_\_\_\_]]

Door Protectors; G[, [\_\_\_\_\_]]

Wall Covering and Panels; G[, [\_\_\_\_\_]]

SD-06 Test Reports

Fire Resistance Rating

SD-07 Certificates

- [ Indoor air quality for wall covering/panels; S
- ][ Indoor air quality for adhesives; S

] SD-10 Operation and Maintenance Data

Corner Guards, Data Package 1; G[, [\_\_\_\_\_]]

Wall Guards, Data Package 1; G[, [\_\_\_\_\_]]

Door Protectors, Data Package 1; G[, [\_\_\_\_\_]]

Wall Covering and Panels, Data Package 1; G[, [\_\_\_\_\_]]

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality

1.3.1.1 Wall Covering and Panels

Provide sheet and high impact resistant resilient materials certified to meet indoor air quality requirements by **UL 2818** (Greenguard) Gold, **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this section. Provide current product certification documentation from certification body.

1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by [UL 2818](#) (Greenguard) Gold, [SCS](#) Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Store materials at approximately [70 degrees F](#) for at least 48 hours prior to installation.

#### 1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for a 1 year period of [one year] [\_\_\_\_] [years] from date of final acceptance of the work.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

To the maximum extent possible, provide wall and door protection items that are standard products of a single manufacturer and furnished as detailed. Drawings show general configuration of products required[, and items differing in minor details from those shown are acceptable].

Submit detailed shop drawings of each wall and door protection item indicated. Include elevations, dimensions, clearances, details of construction and anchorage, and details of joints and connections.

Submit manufacturers' descriptive product data for each wall and door protection item indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for each wall and door protection item indicated in accordance with Section [01 78 23](#) OPERATIONS AND MAINTENANCE DATA.

##### 2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded [PVC free] [acrylic vinyl] [ or ] [injection molded thermal plastic] conforming to the following:

###### 2.1.1.1 Minimum Impact Resistance

[Minimum impact resistance must be [18 ft-lbs/sq. inch](#) when tested in accordance with [ASTM D256](#), (Izod impact, ft-lbs per sq inch notched).] [Minimum impact resistance must be [49.62 ft-lbs/sq. inch](#) when tested in accordance with [ASTM F476](#).]

###### 2.1.1.2 Fire Resistance Rating

Provide the following surface burning characteristics when tested and labeled in accordance with [ASTM E84](#) by a qualified testing agency: maximum flame spread of 25 and a smoke developed rating of 450 or less. Provide material rated as self extinguishing when tested in accordance with [ASTM D635](#). Provide resilient material used for protection on fire rated doors and frames listed by the qualified testing agency performing the tests. Provide resilient material installed on fire rated wood/steel door and frame assemblies tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly are not acceptable.

#### 2.1.1.3 Integral Color

Provide colored components having integral color and matched in accordance with [SAE J1545](#) to within plus or minus 1.0 on the CIE-LCH scales.

#### 2.1.1.4 Chemical and Stain Resistance

Provide materials resistant to chemicals and stains reagents in accordance with [ASTM D543](#).

#### 2.1.1.5 Fungal and Bacterial Resistance

Provide materials resistant to fungi and bacteria in accordance with [ASTM G21](#), as applicable.

### 2.2 CORNER GUARDS

#### 2.2.1 Resilient Corner Guards

Provide [flush mounted] [surface mounted] corner guards, radius formed to profile shown. Provide corner guards that [extend from floor to ceiling.] [are [\_\_\_\_\_] mm [\_\_\_\_\_]feet high.] Furnish mounting hardware, cushions, and base plates. Provide assembly consisting of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous aluminum retainer. Extruded aluminum retainer conforms to [ASTM B221](#), alloy 6063, temper T5 or T6. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of [recycled content for aluminum component of corner guards](#). Flush mounted type guards act as a stop for adjacent wall finish material. Furnish factory fabricated end closure caps for top and bottom of surface mounted corner guards. Provide flush mounted corner guards installed in fire rated wall that maintain the rating of the wall. Manufacturer to provide insulating materials that are an integral part of the corner guard system. Provide exposed metal portions of fire rated assemblies with a paintable surface.

#### 2.2.2 Stainless Steel Corner Guards

Provide stainless steel base material that contains a minimum of 60 percent recycled content. Provide data identifying percentage of [recycled content for steel component of corner guards](#). Fabricate stainless steel base material of[ 14 gauge][ 16 gauge][ 18 gauge][ 20 gauge] thick material conforming to [ASTM A167](#), type 430 or 304. Provide corner guards that [extend from floor to ceiling.][are [\_\_\_\_\_]feet high.] Form corner guard to dimensions shown.

### 2.3 WALL GUARDS

Provide product with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Extruded continuous aluminum retainers must conform to [ASTM B221](#), alloy 6063, temper T5 or T6. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of [recycled content for aluminum component of wall guards, combination handrail/wall guard and handrails](#). Field adjust all end caps and corners to assure close alignment.

#### 2.3.1 Crash Rails and [Bed Locators]

Provide crash rails with snap-on covers of high impact resistant resilient material, minimum [0.078 inch](#) thick, mounted over [2] [[\\_\\_\\_\\_\\_](#)] [inch](#) wide aluminum, minimum [0.062 inch](#) thick retainer, anchored to wall at maximum [24 inches](#) on center. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of [recycled content for aluminum component of crash rail/bed locators](#).

#### 2.3.2 Combination Handrail and Crash Rails

Provide combination handrail and crash rails with snap-on covers of high impact resistant resilient material, minimum [0.078 inch](#) thick, on a continuous, extruded aluminum retainer, minimum [0.072 inch](#) thick anchored to wall at maximum [32 inches](#) on center. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of [recycled content for aluminum component of combination handrail/crash rail](#).

#### 2.3.3 Handrails

Provide handrails with snap-on covers of high impact resistant resilient material, minimum [0.078 inch](#) thick on a continuous extruded aluminum retainer, minimum [0.072 inch](#) thick anchored to wall at maximum [32 inches](#) on center. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of [recycled content for aluminum component of handrails](#). Provide aluminum components with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Provide end caps and corners that are field adjustable to assure close alignment with handrails.

#### 2.3.4 Chair Rails

Provide chair rails with a snap-on cover of high impact resistant resilient material, minimum [0.070 inch](#) thick, on a continuous extruded aluminum retainer, minimum [0.060 inch](#) thick anchored to wall at maximum [32 inches](#) on center. Provide chair rails with slices, cushions, mounting hardware and other accessories standard with the manufacturer. Field adjust all end caps and corners to assure close alignment with chair rails.

### 2.4 DOOR PROTECTORS

Provide[door] [door envelope] [door knob] [and] [door frame] protection items with [high impact resistant acrylic vinyl or polyvinyl chloride resilient material, minimum [ [0.060 inch](#) thick for doors] [and] [ [0.040 inch](#) thick for door frames]] [ [16 gauge](#), type 304 stainless steel for door]. Coordinate door and door frame protection material requirements with door and frame suppliers to insure fit for all components and color matching with other resilient materials. Provide adhesive as recommended by



resilient material manufacturer.

## 2.5 WALL COVERING AND PANELS

Provide wall covering and panels consisting of high impact [PVC free resilient material] [rigid acrylic vinyl or polyvinyl chloride resilient material]. Panel sizes are [ 4 by 8 feet] [ 4 by 10 feet]. Provide wall covering material used on the interior of the building (defined as inside of the weatherproofing system) that meets either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) the VOC content requirements of [SCAQMD Rule 1168](#), or VOC content requirements of [GS-36](#). Provide certification of [indoor air quality for wall covering/panels](#).

### 2.5.1 Rigid Vinyl Acrylic Wall Covering

Provide [ 0.040 inch] [ 0.060 inch] [ 0.075 inch] [ 0.375 inch] thick wall covering.

### 2.5.2 High Impact Wall Panels

Provide wall panel face and edge thickness that are [\_\_\_\_\_] [0.040 inch]. Factory bond panel face to a 0.375 inch thick fiberboard core. Laminate the backside of the panel with a moisture resistant vapor barrier.

### 2.5.3 Rigid Vinyl Acrylic Digital Wall Covering

Provide wall covering thickness of minimum 0.040 inch with high definition graphic file reverse printed on clear sheet and sealed with protective backer. Provide image as [selected from manufacturer standard.] [custom artwork with copyright clearance.] Provide image [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES.] [as indicated on drawings.]

## 2.6 TRIM, FASTENERS AND ANCHORS

Provide [vinyl] [aluminum] [PVC free] trim, fasteners and anchors for each specific installation as indicated.

## 2.7 FINISH

Submit samples indicating color and texture of materials requiring color and finish.

### 2.7.1 Aluminum Finish

Provide aluminum finish accordance with [AA DAF45](#); exposed aluminum with designation [AA-C22A31 chemically etched medium matte, with clear anodic coating] [AA-C22A32 chemically etched medium matte with integrally colored anodic coating]. Provide Class II architectural coating that is 0.4 mil thick. Provide concealed aluminum with mill finish as fabricated, uniform in natural color and free from surface blemishes.

### 2.7.2 Stainless Steel Finish

Provide stainless steel finish in accordance with [ASTM A167](#), Type 302 or 304, finish number 4.

### 2.7.3 Resilient Material Finish

Provide resilient material finish of [embossed [velour] [stipple] [\_\_\_\_\_]] [[fake woodgrain] [high gloss vinyl]] texture with colors in accordance with [SAE J1545](#).

## 2.8 ADHESIVES

Provide adhesive for resilient material in accordance with manufacturers recommendations. Provide sealants and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) the VOC content requirements of [SCAQMD Rule 1168](#), or VOC content requirements of [GS-36](#). Provide certification of [indoor air quality for adhesives](#).

## 2.9 COLOR

Provide color [as specified in Section [09 06 00 SCHEDULES FOR FINISHES](#).] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.]

## PART 3 EXECUTION

### 3.1 INSTALLATION

Do not install items that show visual evidence of biological growth. Install items on surfaces that are clean, smooth, and free of obstructions.

#### 3.1.1 Corner Guards and Wall Guards

- a. Mount guards [as indicated] [on external corners of interior walls, partitions and columns] and in accordance with manufacturer's written installation instructions.
- b. For wall guards, space brackets at no more than [3 feet](#) on centers and anchor to the wall in accordance with the manufacturer's written installation instructions.

##### 3.1.1.1 Stainless Steel Guards

- a. Mount guards [as indicated] [on external corners of interior walls, partitions and columns] and in accordance with manufacturer's recommendations.
- b. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, [anchor corner guards as indicated] [provide continuous [16 gauge](#) thick, perforated, galvanized z-shape steel anchors welded to back edges of corner guards and [wired to metal studs] [expansion bolted to concrete or masonry with four [3/8 inch](#) diameter bolts, spaced [16 inches](#) on centers]]. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Overlap corner guards on finish plaster surfaces.
- c. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, [anchor corner guards as indicated] [anchor corner guards to existing walls with [1/4 inch](#) oval head stainless steel countersunk expansion or toggle bolts] [anchor corner guards with four nominal [0.0516 inch](#) thick,

adjustable galvanized steel anchors, spaced as shown]. Grout spaces solid between guards and backing with portland cement and sand mortar.

- d. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.
- e. For wall guards, space brackets at no more than 3 feet on center and anchor to the wall in accordance with the manufacturer's installation instructions.

#### 3.1.2 Door Protectors

Install protectors after frames are in place, but prior to hanging of doors, in accordance with manufacturer's written instructions. Apply adhesives in controlled environment in accordance with manufacturer's written instructions. Install protection for fire doors and frames in accordance with [NFPA 80](#).

#### 3.1.3 Wall Coverings and Panels

Install as indicated in accordance with manufacturer's written instructions.

-- End of Section --

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## SECTION 10 28 13

## TOILET ACCESSORIES

08/20

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.4 (2011) Product Safety Signs and Labels

## ASTM INTERNATIONAL (ASTM)

ASTM F2285 (2004; R 2016; E 2016) Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use

ASTM G21 (2015; R 2021; E 2021) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-1691 (1994; Rev F) Construction and Material Schedule for Military Medical and Dental Facilities

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Product Schedule; G[, [\_\_\_\_]]

Submit product Schedule indicating types, quantities, sizes, and installation locations by room for each toilet accessory item required. Identify locations using room designations indicated on the drawings.

## SD-03 Product Data

Recycled content for stainless steel toilet accessories; S

[ Item A4995 Table, Diaper Changing, Wall Mounted; G[, [\_\_\_\_]]

] [ Item A5030 Bench, Stall, Shower, Built In; G[, [\_\_\_\_]]

- ][ Item A5047 Cabinet, Medicine; G[, [\_\_\_\_\_]]
- ][ Item A5074 Soap Dish, Recessed, SS, Psychiatric; G[, [\_\_\_\_\_]]
- ][ Item A5080 Dispenser, Paper Towel, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5081 Dispenser, Paper Towel, SS, Recessed, Psychiatric; G[, [\_\_\_\_\_]]
- ][ Item A5082 Dispenser, Paper Towel, Sensor, Hands Free; G[, [\_\_\_\_\_]]
- ][ Item A5083 Dispenser, Paper Towel, Recessed; G[, [\_\_\_\_\_]]
- ][ Item A5084 Dryer, Hands Free, Forced Air, Automatic; G[, [\_\_\_\_\_]]
- ][ Item A5090 Disposal, Sanitary Napkin, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5109 Grab Bar, 1-1/4 inch Dia., SS, 2 Wall, W/C Accessible; G[, [\_\_\_\_\_]]
- ][ Item A5110 Grab Bar, 1-1/4 inch Dia., SS, 2 Wall, Shower Use; G[, [\_\_\_\_\_]]
- ][ Item A5112 Grab Bar, Psychiatric; G[, [\_\_\_\_\_]]
- ][ Item A5115 Grab Bar, Flip-Up, Heavy Duty; G[, [\_\_\_\_\_]]
- ][ Item A5135 Shelf, Utility W/ Mop/Broom Holders, SS, Surf Mntd; G[, [\_\_\_\_\_]]
- ][ Item A5140 Hook, Garment, Security; G[, [\_\_\_\_\_]]
- ][ Item A5145 Hook, Garment, Double, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5150 Hook, Garment, Triple, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5160 Shelf, 8 inch Depth, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5162 Shelf, Fold Down, Stainless Steel; G[, [\_\_\_\_\_]]
- ][ Item A5165 Shelf, 5 inch Depth, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5166 Shelf, 12 inch Depth, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ][ Item A5170 Rod, Shower Curtain, 1 inch Diameter, W/Curtain & Hooks; G[, [\_\_\_\_\_]]
- ][ Item A5175 Soap Dish, With Bar, SS, Recessed; G[, [\_\_\_\_\_]]
- ][ Item A5195 Dispenser, Toilet Tissue, SS, 1-Roll, Surface Mntd; G[, [\_\_\_\_\_]]
- ][ Item A5196 Dispenser, Toilet Tissue, Psychiatric; G[, [\_\_\_\_\_]]
- ][ Item A5200 Dispenser, Toilet Tissue, SS, 2-Roll, Surface Mntd; G[, [\_\_\_\_\_]]

- ][ [Item A5202](#) Dispenser, Toilet Paper w/Utility Shelf, SS, 2-Roll; G  
[, [\_\_\_\_\_]]
- ][ [Item A5205](#) Bar, Towel, 1 inch Diameter, SS, Surface Mounted; G[,  
[\_\_\_\_\_]]
- ][ [Item A5207](#) Bar, Towel, 1 inch Diameter, SS, Surface Mntd, Psych; G  
[, [\_\_\_\_\_]]
- ][ [Item L1200](#) Cabinet, Specimen, Pass Thru, CRS; G[, [\_\_\_\_\_]]
- ][ Submit catalog numbers, literature, data sheets, construction  
details, profiles, anchoring and mounting requirements [,including  
cutouts in other work and substrate preparation,] [,electrical  
characteristics,] and other pertinent data for each toilet  
accessory item to evaluate function, materials, dimensions and  
appearance.

#### SD-07 Certificates

##### Baby Changing Stations

#### SD-10 Operation and Maintenance Data

- [ [Item A4995](#) Table, Diaper Changing, Wall Mounted; G[, [\_\_\_\_\_]]
- ][ [Item A5030](#) Bench, Stall, Shower, Built In; G[, [\_\_\_\_\_]]
- ][ [Item A5047](#) Cabinet, Medicine; G[, [\_\_\_\_\_]]
- ][ [Item A5074](#) Soap Dish, Recessed, SS, Psychiatric; G[, [\_\_\_\_\_]]
- ][ [Item A5080](#) Dispenser, Paper Towel, SS, Surface Mounted; G[,  
[\_\_\_\_\_]]
- ][ [Item A5081](#) Dispenser, Paper Towel, SS, Recessed, Psychiatric; G[,  
[\_\_\_\_\_]]
- ][ [Item A5082](#) Dispenser, Paper Towel, Sensor, Hands Free; G[, [\_\_\_\_\_]]
- ][ [Item A5083](#) Dispenser, Paper Towel, Recessed; G[, [\_\_\_\_\_]]
- ][ [Item A5084](#) Dryer, Hands Free, Forced Air, Automatic; G[, [\_\_\_\_\_]]
- ][ [Item A5090](#) Disposal, Sanitary Napkin, SS, Surface Mounted; G[,  
[\_\_\_\_\_]]
- ][ [Item A5109](#) Grab Bar, 1-1/4 inch Dia., SS, 2 Wall, W/C Accessible; G  
[, [\_\_\_\_\_]]
- ][ [Item A5110](#) Grab Bar, 1-1/4 inch Dia., SS, 2 Wall, Shower Use; G[,  
[\_\_\_\_\_]]
- ][ [Item A5112](#) Grab Bar, Psychiatric; G[, [\_\_\_\_\_]]
- ][ [Item A5115](#) Grab Bar, Flip-Up, Heavy Duty; G[, [\_\_\_\_\_]]
- ][ [Item A5135](#) Shelf, Utility W/ Mop/Broom Holders, SS, Surf Mntd; G[,

[\_\_\_\_\_]]

- ] [ Item A5140 Hook, Garment, Security; G[, [\_\_\_\_\_]]
- ] [ Item A5145 Hook, Garment, Double, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ] [ Item A5150 Hook, Garment, Triple, Surface Mounted; G[, [\_\_\_\_\_]]
- ] [ Item A5160 Shelf, 8 inch Depth, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ] [ Item A5162 Shelf, Fold Down, Stainless Steel; G[, [\_\_\_\_\_]]
- ] [ Item A5165 Shelf, 5 inch Depth, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ] [ Item A5166 Shelf, 12 inch Depth, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ] [ Item A5170 Rod, Shower Curtain, 1 inch Diameter, W/Curtain & Hooks; G[, [\_\_\_\_\_]]
- ] [ Item A5175 Soap Dish, With Bar, SS, Recessed; G[, [\_\_\_\_\_]]
- ] [ Item A5195 Dispenser, Toilet Tissue, SS, 1-Roll, Surface Mntd; G[, [\_\_\_\_\_]]
- ] [ Item A5196 Dispenser, Toilet Tissue, Psychiatric; G[, [\_\_\_\_\_]]
- ] [ Item A5200 Dispenser, Toilet Tissue, SS, 2-Roll, Surface Mntd; G[, [\_\_\_\_\_]]
- ] [ Item A5202 Dispenser, Toilet Paper w/Utility Shelf, SS, 2-Roll; G[, [\_\_\_\_\_]]
- ] [ Item A5205 Bar, Towel, 1 inch Diameter, SS, Surface Mounted; G[, [\_\_\_\_\_]]
- ] [ Item A5207 Bar, Towel, 1 inch Diameter, SS, Surface Mntd, Psych; G[, [\_\_\_\_\_]]
- ] [ Item L1200 Cabinet, Specimen, Pass Thru, CRS; G[, [\_\_\_\_\_]]
- ] Submit Data Package 1 for each toilet accessory item [, and Data Package 2 for each electrical toilet accessory item,] in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

### [1.3 CERTIFICATIONS

#### 1.3.1 Baby Changing Stations

Provide certification that baby changing stations meet the performance criteria of [ASTM F2285](#).

Provide certification that baby changing stations meet the requirements of [ANSI Z535.4](#) Product Safety Signs and Labels.

Provide certification that baby changing stations meet the requirements of [ASTM G21](#) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

#### ]1.4 DELIVERY, STORAGE, AND HANDLING



Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for a period of [one year][\_\_\_\_\_] [years] from date of final acceptance of the work..

PART 2 PRODUCTS

2.1 ACCESSORY ITEMS

Provide toilet accessories where indicated in accordance with Contractor-provided [product schedule](#). Conform to the requirements for accessory items specified herein which are based on [MIL-STD-1691](#) Joint Schedule Numbers (JSN). [ Porcelain type, tile-wall accessories are specified in Section [09 30 10 CERAMIC, QUARRY, AND GLASS TILING.](#)] Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

Provide stainless steel products listed herein manufactured from materials containing a minimum of 50 percent recycled content. Provide data identifying percentage of [recycled content for stainless steel toilet accessories](#).

2.1.1 Anchors and Fasteners

Provide corrosion-resistant anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction. Provide [tamperproof design] [oval heads] exposed fasteners with finish to match the accessory. Provide fasteners proposed for use for each type of wall construction and mounting.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

[2.1.3 [Item A4995](#) Table, Diaper Changing, Wall Mounted

Wall mounted diaper changing table. Construct unit of high density polyethylene plastic impervious to odors, mold and mildew; support a static load of minimum [300 pounds](#). Provide unit to project out from wall approximately [4-1/2 inches](#) when in closed position. Provide contour shaped unit with safety strap. Mounting hardware included.

Approximate open dimensions: [20 inches](#) wide by [36 inches](#) long by [5 inches](#) deep. Approximate closed dimensions: [4 inches](#) deep by [36 inches](#) long by

21 inches high.

] [2.1.4 Item A5030 Bench, Stall, Shower, Built-In

Wall mounted shower seat. Frame made of 18 gauge stainless steel with satin finish. Seat made of one piece of 1/2 inch thick nonporous solid phenolic with slots to permit water to drain, secured to frame with stainless steel carriage bolts and acorn nuts. Mounting hardware included. Seat to support a minimum static load of 250 pounds. Hinge seat to fold up when not in use. Seat complies with ADA guidelines.

Approximate size: 34 inches wide by 22 inches deep by 1/2 inch thick.

] [2.1.5 Item A5047 Cabinet, Medicine

Medicine cabinet constructed of heavy gauge stainless steel and have a mirror mounted in swinging door, a minimum of three shelves, magnetic catch and full length piano hinge. Mirror is 1/4 inch thick first quality float glass electrolytically copper-plated and guaranteed against silver spoilage for 15 years. Cabinet door can be inverted to change from left to right hand swing. Unit has concealed mounting holes. Mounting hardware included.

Approximate size: 17 inches wide by 25 inches high by 4 inches deep.

] [2.1.6 Item A5074 Soap Dish, Recessed, SS, Psychiatric

Recessed mounted soap dish. Soap dish made of stainless steel with matte finish, drawn one-piece seamless construction. Back of unit has welded anchor nuts to receive threaded studs, which are provided with unit. Rim of unit beveled to insure tight fit to wall surface. Soap dish has raised dimples that allow water to drain away and provide a gripping surface to retain soap.

Approximate size: 7 inches wide by 5 inches high by 3 inches deep.

] [2.1.7 Item A5080 Dispenser, Paper Towel, SS, Surface Mounted

Surface mounted unit constructed of stainless steel with satin finish, welded construction, and have full length piano hinge, tumbler lock, refill indicator. Unit has smooth corners, free of burrs and sharp edges. Unit has a capacity of 400 single fold paper towels.

Approximate size: 11 inches wide by 8 inches high by 6 inches deep.

] [2.1.8 Item A5081 Dispenser, Paper Towel, SS, Recessed, Psychiatric

Recessed paper towel dispenser made of stainless steel with brushed finish and satin interior. Unit has no loose or protruding parts and have concealed mounting, anchored to wall with welded anchor nuts. Edges of unit beveled to insure a tight fit to wall surface.

Approximate size: 18 inches wide by 4 inches deep by 8 inches high.

] [2.1.9 Item A5082 Dispenser, Paper Towel, Sensor, Hands Free

Surface mounted paper towel dispenser with hands free operation. Unit made of high impact plastic in a dark translucent color. Unit has the capacity of one standard 8 inch wide by 8 inch diameter 800 ft roll with optional paper length settings. Unit is battery operated by four "D" size alkaline

batteries, and have low battery indicator light, or optional AC power adapter. Unit has keyed lock.

Approximate size: 12 inches wide by 15 inches high by 10 inches deep.

] [2.1.10 Item A5083 Dispenser, Paper Towel, Recessed

Recess mounted paper towel dispenser. Unit constructed of heavy gauge stainless steel with satin finish, all welded construction, have full length piano hinge and tumbler lock. Unit dispenses 300 C-fold or 400 multifold paper towels and be self-feeding until supply is depleted. Towel dispensing slot is snag-free. Unit is ADA compliant.

Approximate size: 12 inches wide by 17 inches high by 4 inches deep.

] [2.1.11 Item A5084 Dryer, Hands Free, Forced Air, Automatic

Surface mounted high speed automatic hand dryer. Unit made of stainless steel with satin finish. Electronic sensor automatically turns dryer on when hands are held under the air outlet opening and cuts off when hands are removed, or after approximately 1-1/2 minutes after dryer turns on. Motor is 5/8 HP. Heating element raises the air temperature to approximately 135 degrees and be vandal proof. Unit meets UL requirements.

Unit requires individual 15 amp circuit.

] [2.1.12 Item A5090 Disposal, Sanitary Napkin, SS, Surface Mounted

Surface mounted sanitary napkin receptacle. Unit made of stainless steel with satin finish and all welded construction. Unit has piano hinge attached at the top and an integral finger depression for opening. For use with disposable paper liners, available separately. Unit may be attached to wall or toilet partition.

Approximate size: 7 inches wide by 4 inches deep by 10 inches high.

] [2.1.13 Item A5109 Grab Bar, 1-1/4 Inch Diameter, SS, 2 Wall, W/C Accessible

Grab bar of 1-1/4 inch diameter satin finish stainless steel with peened gripping surface for use in toilet stall/room. Snap-on flange covers for concealed mounting are stainless steel and equipped with two screw holes for attachment to wall. Grab bars designed to meet and exceed ADA requirements for structural strength. Grab bars designed to withstand loads of 900 pounds when properly installed. Clearance from wall to grab bar is 1-1/2 inches to meet ADA and ANSI codes.

] [2.1.14 Item A5110 Grab Bar, 1-1/4 Inch Diameter, SS, 2 Wall, Shower Use

Grab bar of 1-1/4 inch diameter satin finish stainless steel with peened gripping surface. Snap-on flange covers for concealed mounting stainless steel. Bent ends of tubing pass through the flanges and are Heliarc welded for maximum strength. Grab bars designed to meet and exceed ADA requirements for structural strength. Grab bars designed to withstand loads of 900 pounds when properly installed. Clearance from wall to grab bar is 1-1/2 inches to meet ADA and ANSI codes.

] [2.1.15 Item A5112 Grab Bar, Psychiatric

Grab bar of 1-1/2 inch diameter stainless steel with exposed surfaces in satin finish. Grab bar is 36 inches long, with stainless steel closure plate welded on bottom to prevent an open tie-off gap between the bar and the wall. Flanges are completely Heliarc welded to tube end. Bent ends of tubing pass through the flanges and Heliarc welded for maximum strength.

] [2.1.16 Item A5115 Grab Bar, Flip-Up, Heavy Duty

Flip up grab bar, 30 inches long, made of 1-1/4 inch diameter stainless steel with satin finish with peened or knurled grip. Hinge made from heavy duty cast alloy. All exposed surfaces to have satin finish. Grab bars designed to meet and exceed ADA requirements. Locking mechanism holds the grab bar in the vertical position when not in use. Bar operates with less than 5 pounds of force. Bar designed to withstand more than 250 pounds of downward force when properly installed.

] [2.1.17 Item A5135 Shelf, Utility W/ Mop/Broom Holders, SS, Surf Mounted

Surface mounted mop/broom holder with shelf made of 18 gauge stainless steel with all exposed surfaces in satin finish. Unit has shelf 8 inches deep with shelf support brackets of satin finish stainless steel welded to mounting base, and a minimum of 3 hooks/3 holders. Mop holders have spring-loaded rubber cams and hold mop or broom handle with a diameter between 5/8 inch and 1 inch.

Approximate size: 36 inches wide by 8 inches deep.

] [2.1.18 Item A5140 Hook, Garment, Security

Surface mounted safety hook made of stainless steel and secured to wall with tamper resistant mounting screws, exposed mounting. Mounting hardware to be included. Hook designed to snap down when it exceeds load limit.

] [2.1.19 Item A5145 Hook, Garment, Double, SS, Surface Mounted

Surface mounted double garment hook made of stainless steel with satin finish. For use on door back or wall. Hook comes with concealed mounting bracket secured to concealed wall plate. Mounting hardware included. Flange size is approximately 2 inches by 2 inches.

] [2.1.20 Item A5150 Hook, Garment, Triple, Surface Mounted

Surface mounted garment hook. Unit has three metal hooks with a backplate made of medium oak woodgrain or anodized or polished aluminum finished panel. For mounting directly on wall or to panel.

Approximate maximum weight capacity: 35 pounds.

Approximate size: 18 inches wide by 4 inches high by 3/4 inch deep.

] [2.1.21 Item A5160 Shelf, 8 Inch Depth, SS, Surface Mounted

Surface mounted shelf of 18 gauge stainless steel with all exposed surfaces in satin finish. Shelf has minimum depth of 8 inches. Center bracket and end brackets of stainless steel, welded to shelf. Shelf length [as indicated on drawings.] [is] [ 12 inches.] [ 16 inches.] [ 18 inches.] [ 24 inches.] [ 30 inches.] [ 36 inches.] [ 48 inches.] [ Shelves over 24 inches long have center bracket for support.]

] [2.1.22 [Item A5162](#) Shelf, Fold Down, Stainless Steel

Fold down utility shelf of 18 gauge stainless steel. Top surface of shelf has raised rim. Equipped with heavy-duty internal spring. Edges and corners radiused and burr free. Shelf automatically returns to upright position when not in use. Shelf holds 100 pounds. Mount on wall or toilet partition. Mounting hardware included.

] [2.1.23 [Item A5165](#) Shelf, 5 Inch Depth, SS, Surface Mounted

Surface mounted shelf of 18 gauge stainless steel with all exposed surfaces in satin finish. Shelf has minimum depth of 5 inches. Center bracket and end brackets of stainless steel, welded to shelf. Shelf length [as indicated on drawings.] [is] [12 inches.] [16 inches.] [18 inches.] [24 inches.] [30 inches.] [36 inches.] [48 inches.] [Shelves over 24 inches long have center bracket for support.]

] [2.1.24 [Item A5166](#) Shelf, 12 Inch Depth, SS, Surface Mounted

Surface mounted shelf of 18 gauge stainless steel with all exposed surfaces in satin finish. Shelf has a minimum depth of 12 inches. Shelf is available in various widths. Center bracket and end brackets of stainless steel, welded to shelf. Shelf length [as indicated on drawings.] [is] [12 inches.] [16 inches.] [18 inches.] [24 inches.] [30 inches.] [36 inches.] [48 inches.] [Shelves over 24 inches long have center bracket for support.]

] [2.1.25 [Item A5170](#) Rod, Shower Curtain, 1 Inch Diameter, W/Curtain & Hooks

Shower Curtain Rod with concealed mounting. Shower curtain rod made of satin finish stainless steel, 1 inch diameter, with flanges included, and have white vinyl shower curtain, 72 inches high, and stainless steel curtain hooks. Shower curtain has corrosion resistant grommets, reinforced heading, and treated with antibacterial and flame retardant agents. Shower hooks are stainless steel. Length as indicated on drawings.

] [2.1.26 [Item A5175](#) Soap Dish, With Bar, SS, Recessed

Recessed mounted heavy duty stainless steel soap dish with soap lip and bar, of drawn one-piece seamless construction. Exposed surfaces to be satin finish. Soap dish has raised dimples on soap shelf to prevent soap from slipping. Unit includes dry wall clamp and mounting hardware.

Approximate size: 7 inches wide by 5 inches high by 2-3/4 inches deep.

] [2.1.27 [Item A5195](#) Dispenser, Toilet Tissue, SS, 1-Roll, Surface Mounted

Concealed surface mounted single roll toilet tissue dispenser of satin finish stainless steel. Spindle to be free-spinning for non-controlled delivery, chrome-plated high impact resistant plastic and equipped with heavy-duty internal spring. Unit accommodates standard core toilet paper roll up to 5-1/2 inches diameter. Mounting hardware included.

Approximate size: 7-3/4 inches wide by 2 inches high by 4 inches deep.

] [2.1.28 [Item A5196](#) Dispenser, Toilet Tissue, Psychiatric

Recessed toilet tissue roll holder. Unit constructed of stainless steel with satin finish. Rim of holder to be beveled to insure tight fit to wall surface. Back mounting plate of galvanized steel to have welded anchor

nuts to receive threaded studs. All mounting hardware included.

] [2.1.29 [Item A5200](#) Dispenser, Toilet Tissue, SS, 2-Roll, Surface Mounted

Concealed surface mounted, double roll, toilet tissue dispenser of stainless steel. Unit holds and dispenses two standard [5-1/4 inch](#) diameter rolls of toilet tissue. Spindles are free-spinning for non-controlled delivery, chrome-plated plastic equipped with heavy-duty internal springs.

Approximate size: [7 inches](#) diameter by [4 inches](#) deep.

] [2.1.30 [Item A5202](#) Dispenser, Toilet Paper w/Utility Shelf, SS, 2-Roll

Concealed surface mounted, double roll, toilet tissue dispenser and utility shelf of satin finish stainless steel. Mounting brackets to be welded to shelf. Unit holds two standard [5-1/4 inch](#) diameter rolls of toilet tissue. Spindles are free-spinning for non-controlled delivery, high impact-resistant plastic equipped with internal springs. Edges of shelf is [1/2 inch](#), with hemmed lip on front edge for safety.

Approximate size of shelf: [18 inches](#) wide by [5 inches](#) deep.

] [2.1.31 [Item A5205](#) Bar, Towel, 25 mm (1 inch) Diameter, SS, Surface Mounted

Surface mounted satin finish stainless steel towel bar of [1 inch](#) diameter. Support posts fabricated of heavy solid cast brass with satin finish. Stainless steel set screw keeps bar from rotating in posts. Clearance between towel bar and wall is [1-1/2 inches](#).

] [2.1.32 [Item A5207](#) Bar, Towel, 1-Inch Diameter, SS, Surface Mounted, Psychiatric

Concealed surface mounted [1 inch](#) diameter satin finish stainless steel towel bar with peened gripping surface. Flanges for concealed mounting made of stainless steel. Bent ends of tubing pass through flanges and be Heliarc welded to tubing. Mounting kits and concealed anchoring devices are available from the manufacturers for different types of installations. Clearance between towel bar and wall is [1-1/2 inches](#). Towel bar installed to meet or exceed ADA guidelines.

] [2.1.33 [Item L1200](#) Cabinet, Specimen, Pass-Through, CRS

Pass-through specimen cabinet of all welded stainless steel construction with burr-free edges and all exposed surfaces in satin finish. Flanges of one-piece seamless stainless steel in satin finish. Each door is spring-loaded and secured to cabinet with full-length stainless steel piano hinge. Doors equipped with pull knob, international decal identifying usage, and interlocking mechanism which prevents both doors from being open simultaneously. Unit has spill tray of stainless steel with welded seams.

Approximate size: [13 inches](#) wide by [12 inches](#) high by [6 inches](#) deep.

] PART 3 EXECUTION

3.1 INSTALLATION

Do not install items that show visual evidence of biological growth. Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads.

Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. [Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone sealantsealant specified in Section 07 92 00 JOINT SEALANTS) as they are set to provide a watertight installation.] After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

#### 3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

#### 3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates. Install accessories with corrosion-resistant fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs, or to backplates secured to metal studs.

### 3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

-- End of Section --

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## SECTION 10 44 16

## FIRE EXTINGUISHERS

11/19

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM E814 (2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1 (2021) Fire Code

NFPA 10 (2022; ERTA 1 2021) Standard for Portable Fire Extinguishers

NFPA 99 (2021; TIA 20-1) Health Care Facilities Code

NFPA 101 (2021) Life Safety Code

NFPA 241 (2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NFPA 303 (2021) Fire Protection Standards for Marinas and Boatyards

NFPA 385 (2022) Standard for Tank Vehicles for Flammable and Combustible Liquids

NFPA 409 (2022) Standard on Aircraft Hangars

NFPA 418 (2021) Standard for Heliports

NFPA 505 (2018) Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.106 Flammable Liquids

29 CFR 1910.157 (2003) Portable Fire Extinguishers

## UNDERWRITERS LABORATORIES (UL)

UL 8 (2016; Reprint Dec 2020) UL Standard for

## Safety Water Based Agent Fire Extinguishers

UL 154	(2005; Reprint May 2021) UL Standard for Safety Carbon-Dioxide Fire Extinguishers
UL 299	(2012; May 2021) Dry Chemical Fire Extinguishers
UL 626	(2005; Reprint May 2021) 2-1/2 Gallon Stored-Pressure, Water-Type Fire Extinguishers
UL 2129	(2017; Reprint Apr 2021) UL Standard for Safety Halocarbon Clean Agent Fire Extinguishers

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Fire Extinguishers[; G[, [\_\_\_\_]]]

Accessories[; G[, [\_\_\_\_]]]

Cabinets[; G[, [\_\_\_\_]]]

Wall Brackets[; G[, [\_\_\_\_]]]

Schedule[; G[, [\_\_\_\_]]]

## SD-03 Product Data

Fire Extinguishers[; G[, [\_\_\_\_]]]

Accessories[; G[, [\_\_\_\_]]]

Cabinets[; G[, [\_\_\_\_]]]

Wall Brackets[; G[, [\_\_\_\_]]]

Replacement Parts List[; G[, [\_\_\_\_]]]

## SD-04 Samples

Equipment Samples[; G[, [\_\_\_\_]]]

## SD-07 Certificates

Fire Extinguishers Certifications[; G[, [\_\_\_\_]]]

Manufacturer's Warranty with Inspection Tag[; G[, [\_\_\_\_]]]

### 1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

[ Provide portable fire extinguishers in compliance with NFPA 505 for all ancillary vehicles where Fire Safety Standard for Powered Industrial Trucks, including type designations, special conditions relating to areas of use, conversions, maintenance, or specific operations apply.

#### ]1.3.1 Samples

Provide the following equipment samples: One of each type of fire extinguisher being installed; one full-sized sample of each type of cabinet being installed; three samples of wall brackets and accessories of each type being used.

Use approved samples for installation, with proper identification and storage.

### 1.4 WARRANTY

Guarantee that Fire Extinguishers are free of defects in materials, fabrication, finish, and installation and that they will remain so for a period of not less than [\_\_\_\_\_] years after completion.

Submit the manufacturer's warranty with inspection tag.

### 1.5 PROJECT SCHEDULE

For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

## PART 2 PRODUCTS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: Fire Extinguishers; Accessories, cabinets, Wall Brackets.

### 2.1 SYSTEM DESCRIPTION

#### 2.1.1 Types

Submit fire extinguishers certifications showing compliance with local codes and regulations.

Provide fire extinguishers conforming to NFPA 10. Provide quantity and placement in compliance with the applicable sections of NFPA 1, NFPA 101, [NFPA 99], [NFPA 241], [NFPA 303], [NFPA 385], [NFPA 409], [NFPA 418], [29 CFR 1910.106] and 29 CFR 1910.157.

[ Provide [stored-pressure] [cartridge] [hand-pump] water type fire extinguishers.

] [Provide [foam] type fire extinguishers.

] [Provide carbon-dioxide type fire extinguishers compliant with UL 154.

] [Provide dry chemical type fire extinguishers compliant with UL 299.

] [Provide wet chemical type fire extinguishers compliant with UL 8.

] [Provide clean agent type fire extinguishers compliant with UL 2129.

] [Provide dry powder type fire extinguishers.

] [Provide water mist type fire extinguishers compliant with UL 626.

#### ] 2.1.2 Material

Provide [corrosion-resistant steel] [aluminum] [enameled steel] [\_\_\_\_\_] extinguisher shell.

#### 2.1.3 Size

[ 2 1/2 gallons extinguishers.

] [2 1/2 pounds extinguishers.

] [[5] [10] [15] [20] [30] pounds extinguishers.

#### ] 2.1.4 Accessories

[ Forged brass valve

] [ Fusible plug

] [ Safety release

] [ Antifreeze

] [ Pressure gage

#### ] 2.2 EQUIPMENT

##### 2.2.1 Cabinets

###### 2.2.1.1 Material

Provide [enameled steel] [corrosion-resistant steel] [aluminum] cabinets.

###### 2.2.1.2 Type

[ Provide [recessed] [trimless] [surface] type cabinets.

] [Provide semi-recessed cabinet for a [6 inch] [4 inch] wall.

] [Provide [recessed] [trimless] [surface] bubble type cabinets.

] [Provide a fire rated cabinet, listed and labeled to comply with ASTM E814 for fire resistance wall rating.]

###### 2.2.1.3 Size

Dimension cabinets to accommodate the specified fire extinguishers.

### 2.2.2 Wall Brackets

Provide [ running-board ] [ spring-clip ] [ wall-hook ] fire extinguisher wall brackets.

Provide wall bracket and accessories as approved.

#### 2.2.2.1 Identification

Provide lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by the drawings.

Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

Orientation: [Vertical] [Horizontal].

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install Fire Extinguishers where indicated on the drawings. Verify exact locations prior to installation.

Provide extinguishers which are fully charged and ready for operation upon installation. Provide extinguishers complete with Manufacturer's Warranty with Inspection Tag attached.

Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

Comply with the manufacturer's recommendations for all installations.

### 3.2 PROTECTION

#### 3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

Submit replacement parts list indicating specified items replacement part, replacement cost, and name, address and contact for replacement parts distributor.

#### 3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --

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## SECTION 10 51 13

## METAL LOCKERS

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A568/A568M (2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A924/A924M (2022) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM A1008/A1008M (2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM B456 (2017) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

ASTM D6386 (2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-22750 (2014; Rev G; Notice 1 2019) Coating, Epoxy, High Solids

MIL-PRF-23377 (2012; Rev K) Primer Coatings: Epoxy, High Solids

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-L-00486 (Rev J) Lockers, Clothing, Steel

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Types; G[, [\_\_\_\_\_]]

Location; G[, [\_\_\_\_\_]]

Installation

[ Numbering system]

#### SD-03 Product Data

Material

Locking Devices

[ Lock Control Chart]

Handles

Finish

Locker components

Assembly instructions

#### SD-04 Samples

Color chips; G[, [\_\_\_\_\_]]

### 1.3 DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

### 1.4 FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication. Verify correct location

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Color Chips

Provide a minimum of three color chips, not less than 3 inches square, of each color [scheduled] [indicated].

Government may request performance-characteristic tests on assembled lockers. Tests and results must conform to FS AA-L-00486. Lockers not



conforming will be rejected.

## PART 2 PRODUCTS

### 2.1 TYPES

Locker must have the following type and size in the location and quantities indicated. Locker finish colors will be as scheduled.

#### 2.1.1 Single-tier Lockers

Single-tier lockers must be as follows:

- [ Type STL-1: Single-tier locker 15 inches wide, 15 inches deep, and 72 inches high, attached to 6-inch high legs]
- [ Type STL-2: Single-tier locker 15 inches wide, 18 inches deep, and 72 inches high, attached to 6-inch high legs]
- [ Type STL-3: Single-tier locker 18 inches wide, 21 inches deep, and 72 inches high, attached to 6-inch high legs]
- [ Type STL-4: Single-tier locker 18 inches wide, 24 inches deep, and 72 inches high, attached to 6-inch high legs]
- [ Type STC-1: Single-tier locker 15 inches wide, 15 inches deep, and 72 inches high, attached to 6-inch closed base]
- [ Type STC-2: Single-tier locker 15 inches wide, 18 inches deep, and 72 inches high, attached to 6-inch high closed base]
- [ Type STC-3: Single-tier locker 18 inches wide, 21 inches deep, and 72 inches high, attached to 6-inch high closed base]
- [ Type STC-4: Single-tier locker 18 inches wide, 24 inches deep, and 72 inches high, attached to 6-inch high closed base]
- [ Type STW-2: Single-tier locker 15 inches wide, 18 inches deep, and 72 inches high, without base]
- [ Type STW-3: Single-tier locker 18 inches wide, 21 inches deep, and 72 inches high, without base]
- [ Type STW-4: Single-tier locker 18 inches wide, 24 inches deep, and 72 inches high, without base]

#### 2.1.2 Double-Tier

Double-tier lockers must be as follows:

- Type DTL-1: Double-tier locker 15 inches wide, 15 inches deep, and 72 inches high, attached to 6-inch high legs
- Type DTL-2: Double-tier locker 15 inches wide, 18 inches deep, and 72 inches high, attached to 6-inch high legs
- Type DTC-1: Double-tier locker 15 inches wide, 15 inches deep, and 72 inches high, attached to a 6-inch high closed base

Type DTC-2: Double-tier locker 15 inches wide, 18 inches deep, and 72 inches high, attached to a 6-inch high closed base

Type DTW-1: Double-tier locker 15 inches wide, 15 inches deep, and 72 inches high, without base

Type DTW-2: Double-tier locker 15 inches wide, 18 inches deep, and 72 inches high, without base

## 2.2 MATERIAL

### 2.2.1 [Galvanized] Steel Sheet

[ASTM A1008/A1008M] [ASTM A568/A568M], commercial quality, minimized spangle material. Prepare material surfaces for [baked enamel] [\_\_\_\_\_] finishing in accordance with FS AA-L-00486. [ Fabricate locker bodies from not less than 0.0239-inch thick steel sheet.] [ Minimum uncoated sheet thickness [as specified] [\_\_\_\_\_] .]

[ASTM A653/A653M and ASTM A924/A924M, commercial quality, minimized spangle, galvanized steel sheet with not less than G60 zinc coating. Prepare surface of sheet for painting in accordance with ASTM D6386, Method A. Minimum uncoated sheet thickness [as specified] [\_\_\_\_\_] .]

### 2.2.2 Chromium Coating

Nickel and chromium electrodeposited on the specified base metal. Conform to ASTM B456, SC-3, as applicable to the base metal.

### 2.2.3 Finish

[FS AA-L-00486.]

[Primer, [MIL-PRF-23377] [\_\_\_\_\_] ; topcoat, [MIL-PRF-22750] [\_\_\_\_\_] .]

#### 2.2.3.1 Color

As selected.

## 2.3 COMPONENTS

### 2.3.1 Built-In Locks

[FS AA-L-00486. Provide locking devices as [built-in key locks] [built-in combination locks] [and] [a padlock eye in the door latching mechanism].] [Submit Lock Control Chart showing each lock required for the project, the locker identification plate number, and the lock combination.]

[Built-in locks are not required.]

### 2.3.2 Coat Hooks

FS AA-L-00486, [chromium] [zinc] plated.

### 2.3.3 [Hanger Rods

FS AA-L-00486.

## ]2.3.4 Door Handles

FS AA-L-00486. [Provide zinc alloy or steel handles with a chromium coating.]

## 2.3.5 Doors

FS AA-L-00486, not less than 0.0598 inch thick steel sheet.

## 2.3.5.1 Hinges

In addition to the requirements of FS AA-L-00486, provide 5-knuckle hinges, minimum 2 inches high. Fabricate knuckle hinges from not less than 0.0787 inch thick steel sheet. [A full height piano hinge may be provided if standard with the manufacturer.] Weld or bolt hinges to the door frame. Weld, bolt, or rivet hinges to the door.

## 2.3.5.2 Latching Mechanisms

FS AA-L-00486.

## 2.3.6 Latch Strikes

FS AA-L-00486. Fabricate from not less than 0.0787 inch thick steel sheet, except latch strike may be continuous from top to bottom and fabricated as part of the door framing.

## 2.3.7 Silencers

FS AA-L-00486.

## 2.3.8 Back and Side Panels, Tops, and Bottoms

FS AA-L-00486, not less than 0.0474 inch thick steel sheet.

## [2.3.9 Sloping Locker Tops

Provide sloping locker tops in addition to the locker-section flat tops. Sloping tops must be continuous in length. Provide fillers or closures at the exposed end of sloping tops. Fabricate sloping tops from not less than 0.0478-inch thick steel sheet.

## ]2.3.10 Shelves

FS AA-L-00486. Fabricate from not less than 0.0598 inch thick steel sheet.

## 2.3.11 [Base Panels

FS AA-L-00486.

## ]2.3.12 Legs

[FS AA-L-00486.] [Provide lockers without legs, as indicated.]

## 2.3.13 Number Plates

[FS AA-L-00486. [Aluminum] [Brass] [Zinc]. Provide consecutive numbers from [\_\_\_\_\_] to [\_\_\_\_\_.]

[Number plates are not required.]

#### 2.3.14 [Label Holders

FS AA-L-00486.

#### ]2.3.15 Fastening Devices

Provide bolts, nuts, and rivets as specified in FS AA-L-00486.

### PART 3 EXECUTION

#### 3.1 ASSEMBLY AND INSTALLATION

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall [and base] with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly.

#### 3.2 [NUMBERING SYSTEM

Install number plates on lockers consecutively [with odd numbers on top and even numbers on bottom] [as indicated] [\_\_\_\_\_].

#### ]3.3 FIELD QUALITY CONTROL

##### 3.3.1 Testing

Government may request performance-characteristic tests on assembled lockers in accordance with FS AA-L-00486. Lockers not conforming will be rejected.

##### 3.3.2 Repairing

Remove and replace damaged and unacceptable portions of completed work with new.

##### 3.3.3 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

-- End of Section --

SECTION 10 56 13

STEEL SHELVING

04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- ASTM D522/D522M (2017) Mandrel Bend Test of Attached Organic Coatings
- ASTM D2794 (1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- ASTM D3359 (2017) Standard Test Methods for Rating Adhesion by Tape Test

MATERIAL HANDLING INDUSTRY OF AMERICA (MHI)

- MHI MH28.1 (1997) Specification: Industrial Steel Grade Shelving

1.2 DEFINITIONS

For the purposes of this specification the shelf category, "medium weight," "heavy weight," will be as follows. Load is given per shelf in pounds for evenly distributed load. This does not limit the shelf size, only the shelving category.

Minimum Evenly Distributed Load Per Shelf in Pounds		
Shelf Size	Type Medium Duty	Type Heavy Duty
18 by 36 in.	700	1300
18 by 48 in.	500	900

1.3 SUBMITTALS

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SD-01 Preconstruction Submittals

## Shelving Units

## SD-03 Product Data

## Shelving Units

## Accessories

## Installation instructions

## SD-04 Samples

## Finish

## SD-06 Test Reports

## Shelving Units

## Finish

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original packages, containers or bundles bearing the brand name and identification of the manufacturer. Store inside under cover. Protect surfaces from damage.

## PART 2 PRODUCTS

## 2.1 MANUFACTURED UNITS

**MHI MH28.1.** Provide shelving units [indicated] [scheduled]. Provide shelving units designed for full dead and live load, designated [medium duty] [heavy duty]. [Provide units with base plates for floor anchorage indicated.] [Provide wall connections for units over 8 feet 3 inches to top shelf.] [Provide floor and wall anchorages for units in Seismic Zone 3 or 4. Provide door and drawer earthquake stops.] [Provide wall connections for drawer units if necessary.]

## 2.2 ACCESSORIES

- a. Drawers, 400 pound capacity, and mounting brackets
- b. Partitions and dividers
- c. Label holder [2 1/4 by 3/4 inches] [3 by 5 inches].

## 2.3 FINISH

Provide the shelving units in the manufacturer's standard colors [as indicated] [as chosen by the Contracting Officer]. Clean metal by multiple stage phosphatizing and sealing process, for rust resistance and paint adhesion. Provide electrostatically applied enamel finish coats, baked hard for a minimum of 30 minutes at 300 degrees F. [Provide special finish meeting the flexibility, adhesion, and impact standards below.]

## 2.4 SOURCE QUALITY CONTROL

- a. **MHI MH28.1**, for tests of shelf capacity, lateral stability and shelf

connections.

- [b. Finish flexibility, [ASTM D522/D522M](#), Method A, 1/8 inch diameter, 180 degree bend, no evidence of fracturing to the naked eye.]
- [c. Finish adhesion, [ASTM D3359](#), Method B. There shall be no film removed by tape applied to 11 parallel cuts space 1/8 inch apart plus 11 similar cuts at right angles.]
- [d. Impact resistant finish, [ASTM D2794](#), no loss of adhesion after direct and reverse impact equal to 1.5 times metal thickness in mm, expressed in inch pounds.]

PART 3 EXECUTION

3.1 EXAMINATION

Before installation, examine shelving units for dents and scratches. Replace damaged shelving.

3.2 INSTALLATION

Install shelving according to manufacturer's [installation instructions](#). [Make wall and floor connections as indicated.]

3.3 PROTECTION

Cover and protect shelving from damage during the completion of construction. Remove prior to acceptance of project.

3.4 [SCHEDULE

SHELVING						
Type	Width	Depth	Number of Shelves	Height	Accessories	Room
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]

] -- End of Section --

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## SECTION 12 21 00

WINDOW BLINDS  
08/17, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 SUMMARY

Provide window treatment, conforming to **NFPA 701**, complete with necessary brackets, fittings, and hardware. Provide each window treatment type as a complete unit in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Mount and operate equipment in accordance with manufacturer's instructions. Completely cover windows to receive a treatment.

## 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

**CDPH SECTION 01350** (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 701** (2019) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

**SCS** SCS Global Services (SCS) Indoor Advantage

## UNDERWRITERS LABORATORIES (UL)

**UL 2818** (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.3 SUBMITTALS

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[SD-02 Shop Drawings](#)

[Installation](#)

[SD-03 Product Data](#)

Window Blinds; G[, [\_\_\_\_\_]]

[ Recycled Content for aluminum components; S]

#### SD-04 Samples

Window Blinds; G[, [\_\_\_\_\_]]

Valance; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Window Blinds

#### SD-07 Certificates

[ Indoor Air Quality for window blinds; S]

#### SD-08 Manufacturer's Instructions

Window Blinds; G[, [\_\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Window Blinds; G[, [\_\_\_\_\_]]

### [1.4 CERTIFICATIONS

#### 1.4.1 Window Blinds

Provide products certified to meet indoor air quality requirements by **UL 2818** Greenguard [Gold], **SCS** Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

### ]1.5 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above **50 degrees F**. Do not open containers until needed for installation unless verification inspection is required.

### 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

## PART 2 PRODUCTS

### 2.1 WINDOW BLINDS

Provide each blind, including hardware, accessory items, mounting brackets

and fastenings, as a complete unit produced by one manufacturer. Unless otherwise indicated, all parts will be the same color and will match the color of the blind slat. Treat steel features for corrosion resistance. Submit product data and samples of each type and color of window treatment. Provide [slat][louver] samples 6 inch in length for each color. [ Window blinds must meet emissions requirements of CDPH SECTION 01350 (use the office or classroom requirement, regardless of space type). Provide certification or validation of indoor air quality for window blinds.]

[Provide Aluminum Components with a minimum of [24][\_\_\_\_\_] percent recycled content. Provide data identifying percentage of recycled content for aluminum components.]

[Provide certification of indoor air quality for window blinds.]

#### 2.1.1 Horizontal Blinds

Provide horizontal blinds with[ 2 inch][ 1 inch] slats. Blind units must be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds must be [inside][outside] mount. Provide tapes for 2 inch slats with longitudinal reinforced vinyl plastic in 1-piece turn ladder construction. Tapes for 1 inch slats must be braided polyester or nylon.

##### 2.1.1.1 Head Channel and Slats

Provide head channel made of[ steel or] aluminum with corrosion-resistant finish nominal[ 0.018 inch for 2 inch][ 0.024 inch for 1 inch] slats. Provide slats of aluminum, not less than [0.008][0.006][0.032] inch thick, and of sufficient strength to prevent sag or bow in the finished blind. Provide a sufficient amount of slats to assure proper control, uniform spacing, and adequate overlap. Enclose all hardware in the headrail.

##### 2.1.1.2 Controls

A transparent tilting wand will be provided to tilt the slats, it will hang vertically by its own weight, and will swivel for easy operation. Provide a tilter control of enclosed construction. Provide moving parts and mechanical drive made of compatible materials which do not require lubrication during normal expected life. The tilter will tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. Include a mechanism to prevent over tightening. Provide a wand of sufficient length to reach to within 5 feet of the floor. [Provide cordless blinds or blinds with cords that are out of reach of children and strangle proof.]

##### 2.1.1.3 Intermediate Brackets

Provide intermediate brackets for installation, as recommended by the manufacturer, of blinds over [48][60][84] inch wide.

##### 2.1.1.4 Bottom Rail

Provide bottom rail made of corrosion-resistant steel with factory applied finish. Provide closed oval shaped bottom rail with double-lock seam for maximum strength. Bottom rail and end caps to match slats in color.

#### 2.1.1.5 Braided Ladders

Provide braided ladders of 100 percent polyester yarn, color to match the slat color. Space ladders 15.2 slats per foot of drop in order to provide a uniform overlap of the slats in a closed position.

#### 2.1.1.6 Hold-Down Brackets

Provide universal type hold-down brackets for sill or jamb mount where indicated on placement list.

#### 2.1.2 Light Control and Privacy Blinds

In addition to requirements for horizontal blinds, provide each unit with a feature that offers hidden slat holes for maximum light control and privacy.

#### 2.1.3 Vertical Blinds

Provide vertical blind units capable of nominal 180 degree partial tilting operation and full stackback. Provide blinds that are listed by the manufacturer as designed for heavy duty strength applications including heavy duty hardware. Provide [ceiling][wall] mounted vertical blinds with [outside][inside] brackets. Provide blinds that are [sill][floor] length. Outside mount type installation must provide adequate overlap to control light and privacy.

##### 2.1.3.1 Louvers

Provide louvers [which are fire resistant solid vinyl, UV stable, and impact resistant.] [which are flame retardant fabric having straight, flat, unfrayed edges and flat, without noticeable twists. Provide a weight at the bottom of the louver without the insert discoloring the fabric.] [which are groover extruded from solid vinyl with clear non-yellowing channel lips to accept fabric inserts. Provide fabric inserts that are flame retardant and colorfast.] Louvers that are [ 3-1/2 inch must overlap not less than 3/8 inch] [ 2 inch must overlap not less than 1/4 inch] and be dimensionally stable.

##### 2.1.3.2 Carriers

Provide carriers to support each louver made of molded plastic to transverse on self-fabricated wheels for smooth, easy operation. The hook of the carrier must have an automatic latch to permit easy installation and removal of the louver, and to securely lock the louver for tilting and traversing.

##### 2.1.3.3 Headrail System

Provide headrail system not less than 0.047 inch thick and made of anodized aluminum alloy or 0.027 inch thick phosphate treated steel with a baked on ivory gloss enamel paint finish. Provide a headrail that extends the full width of the blind and can be closed with an end cap at each end. One cap will contain the traversing and tilting controls. The opposite cap will house the pulley for the traversing cord.

##### 2.1.3.4 Valance

Attach the manufacturer's standard valance to the headrail by metal or plastic holders which grip the top and bottom edge of the valance and

accept an insert of the same material as the slats. Provide sufficient clearance behind the valance to permit the louvers to tilt without interference. Extend the headrail cover the full width of the blind.[ Provide returns].

2.1.3.5 Controls

Provide tilting and traversing controls that hang compactly at the side of the blinds and reach within 5 feet of the floor. Provide [tilt/traverse control][bead chain tilting control] that tilts all vanes simultaneously to any desired angle and hold them at that angle. Provide louvers that traverse [one way to the right] [one way to the left] [two-way split]. [The traversing control cord will be minimum 0.070 inch in diameter with a minimum breaking strength of 125 pounds. Anchor the cord to a lead carrier linked to all adjacent carriers.] Provide louvers that traverse along the headrail by pulling one side of the looped cord [fastened to a cord tension pulley][ or ] [a fiberglass wand that tilts the louvers by turning the wand and traverses the louvers by using the wand as a control]. Sliding glass doors will have a one way draw with stackback occurring opposite door openings.

2.1.3.6 Connectors and Spacers

The connector must be flexible, smooth and flat to slide unhindered when carriers move independently of each other, and to nest compactly when carriers are stacking. Relate the length of the links to the louver width in order to equally space the traversing louvers, to maintain uniform and adequate overlap of louvers, and to fully cover the width of the opening.

2.1.3.7 Intermediate Brackets

Provide intermediate installation brackets for blinds over 62 inches wide.

2.2 COLOR

Provide color, pattern and texture [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated] [selected from manufacturer's standard colors] [[\_\_\_\_\_]]. Color listed is not intended to limit the selection of equal colors from other manufacturers.]

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 WINDOW TREATMENT PLACEMENT SCHEDULE

[All exterior windows include [\_\_\_\_\_].] [Provide window covering as follows:

Room Number/Name	Window Covering Type	Vertical Blind Draw Direction	Window Type	Quantity
[_____]	[_____]	[_____]	[_____]	[_____]

]

3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Submit drawings showing fabrication and Installation details. Show layout and locations of track, direction of draw, mounting heights, and details. Provide Manufacturer's Instructions and Operation and Maintenance Data. Perform installation of window blinds in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Provide and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

#### 3.4 CLEAN-UP

Upon completion of the installation, inspect window treatments for soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, must be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75 inch or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

## SECTION 12 22 00

CURTAINS AND DRAPES  
08/16, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

**ASTM D3691/D3691M** (2019) Standard Performance Specification for Woven, Lace, and Knit Household Curtain and Drapery Fabrics

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

**CDPH SECTION 01350** (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

**NFPA 701** (2019) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

**SCS** SCS Global Services (SCS) Indoor Advantage

## UNDERWRITERS LABORATORIES (UL)

**UL 2818** (2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-02 Shop Drawings**

Drawings; G[, [\_\_\_\_\_]]

**SD-03 Product Data**

Draperly System

#### SD-04 Samples

##### Drapery Fabric; G[, [\_\_\_\_]]

Submit a range of three samples, 36 by 36 inches or larger, to match the fabric quality, weight, pattern, and color shown or specified. Once selected, label approved samples to identify locations for their use in the project. Maintain identification and approval markings until final acceptance of the work.

##### Motor and Controller; G[, [\_\_\_\_]]

##### Finished Drapery

Provide one full size window sample installation including hardware. Install the finished drapery on a [stationary] [traverse] [rod] [or] [track] [at the location indicated].

#### SD-06 Test Reports

##### Flame Resistance

#### SD-07 Certificates

##### Indoor Air Quality for Fabrics; S

#### SD-08 Manufacturer's Instructions

##### Drapery Hardware

##### Motor and Controller

##### Special Fabrication

Before fabrication, submit the manufacturer's printed instructions for fabrics requiring special fabrication methods.

#### SD-10 Operation and Maintenance Data

##### Drapery System, Data Package 1; G[, [\_\_\_\_]]

##### Motor and Controller

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

### [1.3 CERTIFICATIONS

#### 1.3.1 Indoor Air Quality Certifications

##### 1.3.1.1 Fabrics

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.



## ]1.4 DRAWINGS

Submit drawings indicating the following:

Windows and other locations requiring drapery extent of drapery, to ceiling or to specific height above windows; location of each different drapery fabric when more than one type, pattern or color is to be provided; width of window and width of drapery extension if bay window. **Motor and Controller location and any integrated components or accessories.**

## 1.5 SYSTEM REQUIREMENTS

Submit data for completed **drapery system** in accordance with Section **01 78 23 OPERATION AND MAINTENANCE DATA**. Include laundering and dry cleaning instructions for fabrics requiring special care. Furnish separate instruction sheet for each material (one for fiberglass, one for Verel). For fabrics which are not permanently or inherently flame resistant, furnish instruction to include frequency and process required for retreating the fabric to renew the effectiveness of the flame resistant treatment. Head each sheet with name and number of room or rooms in which each material is hung. In lieu of instruction sheets, provide instructions on small, permanent labels (either iron-on type or sewn-on) affixed to back of the heading of each panel.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver draperies and hardware to the site in sealed containers clearly labeled with manufacturer's name and contents. Store in a safe, dry, clean, and well ventilated area. Do not open containers until needed for installation, unless verification inspection is required.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Fabrics

Provide fabrics meeting the emissions requirements of **CDPH SECTION 01350** (limit requirements for either office or classroom spaces regardless of space type). Provide certification or validation of **indoor air quality for fabrics**.

## 2.1.1.1 Drapery Fabric

**ASTM D3691/D3691M**. Provide fabric manufactured from [man-made] [or] [natural] fibers. Fabric physical characteristics must be as [indicated.] [follows:]

- a. Finished fabric weight: [\_\_\_\_\_] to [\_\_\_\_\_] ounces per square yard
- b. Pattern: [Printed] [Woven] [\_\_\_\_\_]
- c. Weave: [Open (25.1 to 50 percent)] [Semi-open (7.1 to 25 percent)] [Closed (0 to 7 percent)]
- d. Texture: [Burlap] [Smooth] [Twill] [\_\_\_\_\_]
- e. Color: [\_\_\_\_\_]

f. Shading coefficient (single glass with drapery): [\_\_\_\_\_]

[\_\_\_\_\_] A sample of each drapery fabric to be matched is on display at [\_\_\_\_\_].

#### ]2.1.1.2 Drapery Lining

[Insulated], [soft blackout,] [\_\_\_\_\_], color [\_\_\_\_\_] [as indicated].

#### 2.1.1.3 Flame Resistance

**NFPA 701.** Drapery fabric and lining must pass the [small] [and] [large] scale test. Treatment to enhance flame resistance must be [permanent] [renewable] type. If treated, fabric must pass the [small] [and] [large] scale test after being subjected to the accelerated dry cleaning or laundering cycles specified in **NFPA 701**.

#### 2.1.2 Sewing Thread

Pre-shrunk mercerized cotton (50/3) or monofilament in equivalent size, except do not use monofilament in the heading.

#### 2.1.3 Heading

##### 2.1.3.1 Heading Hooks

Slip-in-type, [bright zinc-plated] [chromium-plated,] [nickel-plated steel,] and of a size adequate to hold the heading upright. Provide one hook for each pleat. Provide 10 percent [\_\_\_\_\_] surplus hooks for possible lost or damaged hooks.

##### 2.1.3.2 Snap-Tape System (Ripplefold)

Heavy vinyl or nylon tape with locking fasteners attached to tape to form desired pleat spaces and fullness. Cut tapes to size and sew to drapery fabric to form the heading.

#### 2.1.4 Drapery Hardware

[Stationary] [and] [traverse] [wall-mounted rods] [and] [ceiling mounted tracks] of heavy-duty type. [Traverse rods or tracks must be [manually operated] [motorized], [center close two-way] [one-way draw] [left-to-right] [right-to-left]]. Rods and tracks must be cold-rolled, commercial quality steel minimum 0.030 inch thick or extruded aluminum minimum 0.050 inch thick. Rod and track cross section width and depth must be sufficient to carry the drapery without sagging. Track configuration (number of channels) must be such so as to permit drapery operation as specified or indicated. Finish steel components with a [white] [\_\_\_\_\_] baked enamel, vinyl, or epoxy coating as standard with the manufacturer. Finish aluminum components with [an anodic [clear (natural)] [bronze] [\_\_\_\_\_] coating] [a baked enamel, vinyl, or epoxy coating] as standard with the manufacturer. Provide smooth and non-sticking sliding surfaces. Provide one-piece rod and track up to 16 feet long. Provide steel brackets and intermediate supports. Provide one manufacturer's design throughout.

##### 2.1.4.1 Track Sets

Include ceiling track, sliding or rolling carriers, and caps for stationary draperies; ceiling track, sliding or rolling carriers, master sliding or

rolling carriers, ball bearing end pulleys, and traverse cord with cord [tassels] [tension pulleys] for traverse draperies.

#### 2.1.4.2 Rod Sets

Include wall-hung rod, sliding or rolling carriers, brackets, and intermediate supports with 2-1/2 to 3-1/2 inch projection for stationary draperies; wall-hung rod, sliding or rolling carriers, master sliding or rolling carriers, ball bearing end pulleys, brackets, intermediate supports with 2-1/2 to 3-1/2 inch projection, and traverse cord with cord [tassels] [tension pulleys] for traverse draperies.

#### 2.1.4.3 Traverse Cord

Size No. 4 with fiberglass center. Provide cord [tassel with lead weight center and plastic coating] [tension pulley, metal tube type, with mounting bracket, helical spring, and ball bearing pulley wheel]. Finish color, white or off-white.

#### 2.1.4.4 Hand Traverse Cordless Track System

Extra heavy duty track assembly with baton on roomside of draperies where it is readily visible and easily used. [Ceiling mounted] [side-wall mounted] in extruded aluminum track anodized in [clear (natural)] [bronze] [\_\_\_\_\_] finish.

#### 2.1.4.5 Motor and Controller

Provide motor[s] for [single][double] track system, complete with remote controller and manufacturer's instructions for installation and operation. Verify motor size is adequate for drapery system to be installed. Coordinate with [existing][new] electrical system for power supply and location of motor mounting. [Coordinate thermostatic setting instructions for automated systems.]

#### 2.1.4.6 Snap-Tape System Track

Dovetail slots in clear folding linkage. Provide one-piece molded plastic snap tab type carriers with snap-on components sewn to drapery heading.

#### 2.1.5 Fasteners

Provide [zinc][cadmium][\_\_\_\_\_] plated.

### 2.2 FABRICATION

Prior to cutting and fabrication, field measure each drapery location paying particular attention to field conditions affecting the work.

#### 2.2.1 Drapery Fabrication

##### 2.2.1.1 Panels

Make from full or half widths of fabric to give a minimum of [200] [250] [300] [\_\_\_\_\_] percent fullness. [\_\_\_\_\_] percent fullness is defined as [2] [2 1/2] [3] [\_\_\_\_\_] times the rod width plus overlaps and returns. Provide [conventional french pleats] [ripplefold]. Draperies must be [floor] [sill] [apron] length. [Floor length draperies must hang 1 inch above finish floors.] [Sill length draperies must hang 1/2 inch above window

sills and heating-air conditioning units.] [Apron length draperies must hang 1 inch below bottom of window aprons.] Provide table-sized drapery panels with a plus or minus tolerance of 1/4 inch accurately laid-out before cutting. Cut fabric to allow for pleats and for outside ends to return to the walls. For traverse draperies, allow for a minimum overlap of 3 inches at the center. Accurately match patterned fabrics to provide identical designs horizontally and vertically on each window within each room. Where variations in length or placement of windows occur in a room, match patterns horizontally. When fabricating panels from fabrics which require special methods or instructions, conform to the workroom instructions provided by the fabric manufacturer. Sew seams and hems using a firm interlocking stitch at a stitch rate per inch appropriate to fabric being sewn. Sew with enough slack present so that thread shrinkage due to laundering and dry cleaning will not pucker seams and hems. Do not expose seam and hem raw edges.

#### 2.2.1.2 Headings

Pleat evenly to required widths. Make headings 4 inches high with triple french pleats, and double fold. Include permanent finish stiffener of buckram, crinoline, or pella across entire heading. Paper stiffening is not acceptable. Machine stitch pleats for a depth of at least 3-3/4 inches. Do not use horizontal stitching across the width of the heading.

#### 2.2.1.3 Seams

Join widths by serging, overlock, and safety stitch. Retain selvage when practical.

#### 2.2.1.4 Hems

Double fold hems (top and bottom) and blind stitch so as not to show on the panel face. Make side seams 1-1/2 inches wide and bottom seams 4 inches deep with weights sewn 1/2 inch above hem bottom. Provide weights at corners and each vertical seam. When lining is attached to the drapery fabric, single fold heading is acceptable, however, double fold the bottom hem.

#### [2.2.2 Lining Fabrication

Lock stitch lining to the back of the fabric panel. Hem fabric panel and lining panel separately at the bottom.

#### ] [2.2.3 Tie-Backs

Make from [same material as draperies] [\_\_\_\_], [3] [\_\_\_\_] inches wide by [30] [\_\_\_\_] inches long. Fabricate from a double thickness of fabric, press flat to provide specified width, and locate seam at the bottom fold so as to permit the tie-back to be reversible. Provide bone or plastic ring end fastenings to loop over tie-back hooks.

#### ] [2.2.4 Valances

[Rod-hung, fabricated in the same manner as draperies and of [same material] [\_\_\_\_].] [Box-type, with sides and top constructed of 1 inch thick [softwood pine] [\_\_\_\_], and 3/8 inch thick plywood front. Cover front, sides and bottom edges of valance with batting, stretch fabric [and trim] evenly and neatly over valance exterior, and fasten to the inside. Provide [same fabric as draperies] [\_\_\_\_]. Paint interior of valance.

Shape valance bottom front edge [straight] [\_\_\_\_].] Make valance of required width to span the window, and [\_\_\_\_] inches high. Make depth of valance adequate to ensure proper appearance and to permit proper operation of traverse draperies.

]PART 3 EXECUTION

3.1 EXAMINATION

Ensure that work of other trades and cleaning operations are completed. Test completed installation to ensure smooth and continuous operation of all draperies, hardware and accessories.

3.2 INSTALLATION

Install draperies in rooms and areas [indicated] [as scheduled herein]. Include all material indicated, specified, or necessary for a complete finished drapery installation. Contractor is responsible for the required quantities of draperies and hardware.

Do not install building construction materials that show visual evidence of biological growth.

3.2.1 Hardware

Install in accordance with the manufacturer's printed instructions and as specified herein. Install ceiling tracks parallel to walls and windows, fasten at each end, at 16 inches from each end and with additional intermediate fasteners spaced not more than 48 inches apart. Install wall rods with end brackets and provide intermediate support brackets 24 inches from each end with additional intermediate support brackets spaced not more than 48 inches apart. Provide fasteners for installation as follows:

<u>Fastener</u>	<u>Structural Material</u>
Wood or sheet metal screw	Wood
Self tapping screw	Metal
Case hardened, self-tapping sheet metal screw	Sheet metal
Screw or bolt in expansion shield	Solid masonry
Toggle or molly bolt	Hollow masonry, wallboard, plaster

3.2.2 Draperies

Install with a minimum clearance of 1/4 inch between the ceiling and top of drapery heading. Floor length draperies must hang 1 inch above finished floors; sill length, 1/2 inch above window sills and heating-air conditioning units; and apron length, 1 inch below bottom of window aprons. Insert heading hooks at rear of each pleat, placed to obtain the clearance specified. Press well before hanging, except fiberglass. Dress-down and adjust hung draperies to provide best form and appearance. Traverse draperies must operate smoothly and easily over the full range of travel. Remove incorrectly sized drapery and remake to correct size. Remove damaged, spotted, or otherwise defective fabric and repair to original state or replace with new material.

3.2.3 Valances

Install with top edge parallel to ceiling.

3.3 DRAPERY SCHEDULE

[ All exterior windows include [\_\_\_\_] ].

] [Provide window covering as follows:

Room Number/Name	Window Covering Type	Drapery Draw Type/Direction	Window Type	Quantity
[____]	[____]	[____]	[____]	[____]

] 3.3.1 IDENTIFICATION

In accordance with the numbering plan, mark each opening and the corresponding window treatment with identical numbers. For multiple windows separated by mullions, the space required by each blind must be numbered separately. Use brass, aluminum, plastic, durable paper plates, or stamp to place corresponding numbers on unexposed surfaces of openings and inside or on top of the headrail track.

-- End of Section --

## SECTION 12 35 30.23 20

## BATHROOM CASEWORK

08/11

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS  
1-09, Structural Plywood

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A (2017) Colors used in Government  
Procurement

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50565 (Basic; CANC Notice 1) Cabinet, Storage;  
Wardrobe, Three Drawer

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Vanities; G[, [\_\_\_\_\_]]

Show configuration, materials, thicknesses, hardware, finishes, and colors of vanities for the project.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver vanities undamaged and store in a safe, dry, and clean location. Handle so as to prevent damage.

## PART 2 PRODUCTS

## 2.1 VANITIES

Provide, [single lavatory type with double doors, Size [(30 inches wide)] [(36 inches wide)] [(42 inches wide)] [(48 inches wide)]] [double lavatory type with two sets of double doors, Size (60 inches wide)] [The type and size shall be [as indicated] [[\_\_\_\_\_] inches wide]], and except as specified herein. Wood construction shall be used. Particleboard shall

not be used. Countertop, doors, and all wood panels shall be 3/4 inch plywood, APA L870, Exterior Type, Grade A-A. Chromium-plated brass pulls or aluminum pulls and chromium-plated, spring-loaded, self-closing, adjustable, European type hinges may be used in lieu of pulls, hinges, and magnetic catches.

#### 2.1.1 Quantity

[\_\_\_\_\_] [As indicated].

#### 2.2 FINISHES

Five-digit designations refer to SAE AMS-STD-595A.

##### 2.2.1 Exposed Surfaces

Exterior of doors and exposed surfaces of cabinet body shall be decorative laminated plastic of color and pattern [indicated] [specified].

##### 2.2.2 Concealed Surfaces

Interior of doors and cabinet body, and concealed exterior surfaces of cabinet body, shall be nondecorative laminated plastic.

#### 2.3 END CURBS

Provide end curbs to match back splash where end of countertop abuts a wall.

#### 2.4 DRAWERS

Where drawers are indicated in vanities, comply with CID A-A-50565 for drawers, drawer slides, and slide supports.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Final Assembly

Distribute vanities to rooms [as indicated] [as directed]. Uncrate, assemble, adjust as necessary, and place as specified or indicated, complete with accessories and hardware. Position vanities [as indicated] [as directed].

##### 3.1.2 Fastening

Fasten wood vanities as indicated on the drawings and as specified. Fasten steel vanities through the holes in vanity back flanges. Fasteners shall be appropriate for use with the wall construction. Seal joint between back splash and wall and between end curb and wall as specified in Section 07 92 00 JOINT SEALANTS.

-- End of Section --



## SECTION 12 35 39

## COMMERCIAL KITCHEN CASEWORK

08/17, CHG 1: 08/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## NSF INTERNATIONAL (NSF)

NSF/ANSI 2 (2021) Food Equipment

NSF/ANSI 35 (2020) High Pressure Decorative Laminates for Surfacing Food Service Equipment

## U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M (2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures

## 1.2 DEFINITIONS

Refer to Section 11 06 40.13 FOODSERVICE EQUIPMENT SCHEDULE.

## 1.3 SUMMARY

General requirements, including all mechanical, electrical, health and safety, are specified in Section 11 05 40 COMMON WORK RESULTS FOR FOODSERVICE EQUIPMENT. Provide detailed equipment Schedule conforming to DOD 4000.25-1-M.

## 1.3.1 General Requirements

The work includes [furnishing] [and] [installing] [and modifying existing] [casework] [countertops] [slide rails] [\_\_\_\_\_] for foodservice and related work. Verify all existing dimensions, contract drawings, product data and all related conditions prior to commencing rough-in work. Include coordination of delivery through existing finished opening and vertical handling limitations within the building. Advise the Contracting Officer of all discrepancies prior to ordering equipment. Submit Field Verification Data prior to the preconstruction meeting. Provide rough-in and connect utilities to equipment in accordance with requirements specified in Section 11 05 40 COMMON WORK RESULTS FOR FOODSERVICE EQUIPMENT and with the physical dimensions, capacities and other requirements of the equipment furnished. Submit Detail Drawings for foodservice casework, countertops, and rails in the same format as the equipment schedule on the drawings.

## 1.3.2 Foodservice Configuration

Submit coordinated detail drawings for [casework] [countertops] [slide rails] [\_\_\_\_\_]. On layout drawing, use Naval Equipment Symbols designated herein. Refer to Section 11 05 40 COMMON WORK RESULTS FOR FOODSERVICE

EQUIPMENT for complete detail drawing requirements. Follow all the applicable NSF International standards for equipment. Submit within [60] [\_\_\_\_\_] days of award of contract. Drawings scale: (1/4 inch) minimum..

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-01 Preconstruction Submittals

Field Verification Data; G[, [\_\_\_\_\_] ]

##### SD-02 Shop Drawings

Foodservice Configuration; G[, [\_\_\_\_\_] ]

Food Service Equipment Schedule; G[, [\_\_\_\_\_] ]

##### SD-03 Product Data

Recycled Content for steel components; S

##### SD-04 Samples

Closure Panels; G[, [\_\_\_\_\_] ]

#### 1.5 PRE-INSTALLATION MEETINGS

Thirty [\_\_\_\_\_] days prior to the commencement of work, notify the Contracting Officer that the submittal items listed above are prepared and ready for review.

#### 1.6 DELIVERY, STORAGE AND HANDLING

Submit and comply with manufacturer's instructions for shipping, handling, storage, installation and start-up.

### PART 2 PRODUCTS

#### 2.1 STEEL COMPONENTS

Provide Steel Components with a minimum of 60 percent recycled content. Provide data identifying percentage of recycled content for steel components.

#### 2.2 CAFETERIA; BUFFET; HOT AND COLD COUNTERS

##### 2.2.1 Counter Edges and Backsplashes

##### 2.2.1.1 Counter Edges

Provide counter edges, as required by design, of the following types:

##### 2.2.1.1.1 Turned Down

2 inch at 90 degrees with 3/4 inch tight hem at bottom. Round free corners with 3/4 inch radius.

#### 2.2.1.1.2 Marine Edge

Turned up [ 1/2 inch] [and] [ 1-1/2 inch] at 45-degree angle and turned down 2 inch at 135 degree angle with 3/4 inch tight hem at bottom.

#### 2.2.1.1.3 Rolled Rim

Coved up 3 inch with 1-1/2 inch wide rim rolled 180 degrees and turned down to table top; hem edges, and bullnose corners.

#### 2.2.1.2 Counter Backsplash

Provide counter backsplash of the following types:

##### 2.2.1.2.1 Coved Up

Coved up [10] [\_\_\_\_\_] inch and sloped back 1-1/2 inch at the top on a 45-degree angle; 2-1/2 inch slope where piping occurs. Turned down 1 inch at 135 degrees at the rear of the splash with the ends closed to the bottom of the top turn down. Secure splash turn down to wall with 4 inch long, 14 gauge stainless steel "zee" clips anchored to wall, 36 inches on center.

##### 2.2.1.2.2 Turned Up

Turned up [6] [\_\_\_\_\_] inch at 90 degrees on a 5/8 inch radius with edge turned back [ 1 inch] [ 2 inch] at 90-degree angle with 1 inch turn down at 90 degrees at rear of splash with the ends closed to the bottom of the top turn down. Secure splash turn down to wall with 4 inch long, 14 gauge stainless steel "zee" clips anchored to wall, 36 inch on center.

#### 2.2.2 Counter Bases

##### 2.2.2.1 Closed Counter Bases

Fabricate with 1.5 by 1.5 by 0.125 inch galvanized steel angles with all corners mitered, welded and ground smooth. Provide horizontal and vertical angles at 2 feet on-center. Fabricate closure panels of 18 gage thick stainless steel or 18 gage thick galvanized steel with laminated plastic material in accordance with NSF/ANSI 35. Fabricate joint trim of 2 inch wide, 14 gage thick stainless steel; attach with concealed bolts or screws. For enclosed bases provide double-wall at ends and partitions. Weld support legs to body support angles. [Use closed-type bases on [\_\_\_\_\_] .]

##### 2.2.2.2 Open Counter Bases

Fabricate and crossbrace with 1.625 inch outside diameter, 16 gage thick stainless steel tubing. Weld crossbraces to legs to reinforce each leg. Weld legs to gussets. Make gussets of stainless steel, fully enclosed, a minimum of 3 inches in diameter at top, reinforced with bushing, and continuously welded to support channels located under the counter top. [Use open-type bases on [\_\_\_\_\_] .]

#### 2.2.3 Legs

Fabricate of 16 gage thick, 1.625 inch outside diameter stainless steel

tubing. Continuously weld to angles on closed bases and gussets on open bases. Finish bottom of legs smoothly. Overlap stem of feet to provide a sanitary fitting.

#### 2.2.4 Pedestal Bases

Fabricate of 12 gage thick stainless steel for serving line counters. Make pedestal 8 inches high, 10 inches wide, and 24 inches long with top and bottom edges flanged 1.5 inch to the inside at 90 degrees. Provide holes in both flanges for 0.5 inch lag screws. Locate utility stub-ups inside pedestal and run to designated equipment.

#### 2.2.5 Feet

Die-stamped stainless steel, bullet shaped, fully enclosed, with slightly rounded bottom. Fit top of feet with male threaded stem to mate with end of legs and provide for a 1 inch adjustment without threads being exposed.

#### 2.2.6 Casters

Provide heavy-duty, ball bearing disc wheel, with replaceable grease-proof rubber or neoprene tires and brakes. Provide tires with minimum 5 inch diameter and minimum one inch width of tread and 200 pounds capacity per caster. Provide pressure-type grease fittings, threaded guards, and plated finish.

#### 2.2.7 Open Base Shelves

Fabricate of 16 gage thick stainless steel with all edges turned down 2 inches at 90 degrees on a 0.25 inch radius with bottom edges turned back 0.5 inch at 45 degrees. Notch corners 90 degrees, and intersections 180 degrees. Weld to legs at corners and intersections. Locate legs maximum 48 inches apart. Shelving to be removable without use of tools.

#### 2.2.8 Closed Base Interior Shelves

Fabricate of 16 gage thick stainless steel. Turn back and side edges up 2 inches at 90 degrees on a 0.25 inch radius. Turn front edge down 2 inches at 90 degrees on a 0.25 inch radius and back 0.25 inch at 45 degrees. Reinforce shelves longer than 30 inches with 1.5 by 1.5 by 0.125 inch galvanized steel angles under front edge and horizontal center of the shelf. Shelving to be removable without use of tools.

#### 2.2.9 Shelf Pan Slides

Provide 14 gage thick stainless steel 1.5 by 1.5 by 0.125 inch angles, with front and back corners rounded and finished smooth. Set angles at 2 inches on-center for 18 by 26 inch bun pans and 12 by 20 inch serving pans.

#### 2.2.10 Drawers

Provide die-stamped 18 gage thick stainless steel, 20 by 20 by 5 inch deep. Ensure drawer body can be easily removed for cleaning with top edges flanged out 0.5 inch. Round interior horizontal corners on a one inch radius and interior vertical corners on a 2 inch radius. Fabricate supporting frame of 14 gage thick stainless steel channel. Weld drawer face to frame. Die-stamp drawer face with raised border for rigidity. Die-form an integral open sanitary handle into face. Mount drawer slides with ball bearing nylon or stainless steel rollers on channel frame.

Provide with slides and frame which allow for full opening of drawer, and are reinforced to support a weight of 50 pounds when fully extended. Provide stops for each drawer at fully open position. Enclose drawers on open-base tables in 18 gage thick stainless steel housing.

#### 2.2.11 Doors

Provide stainless steel double-cased doors, 18 gage thick outer pan with corners welded, ground smooth and polished; 20 gage thick inner pan fitted tightly into outer pan with core of sound deadening material. Tack-weld outer and inner pans together with solder-filled seam. Provide doors approximately 0.75 inch thick and fitted with flush-recessed, stainless steel door pulls. Mount doors on stainless steel piano or concealed hinges.

### 2.3 TRAY SLIDE

[Solid] [Tube] type, 12 inch wide; mounted 34 inches above floor. Extend to full length of supporting counter.

#### [2.3.1 Solid Type

Provide solid type constructed with 14 gage thick stainless steel with front and back edges rolled 1.75 inch at 180 degrees. Ensure top edge of roll is 0.375 inch above flat surface of slide. Provide three inverted "V" forms, approximately 0.375 inch high, in flat surface of slide as running surface for trays. Close ends of slide.

#### ] [2.3.2 Tube Type

Provide four one inch diameter 16 gage thick stainless steel tubes with supporting hardware. Close both ends of each tube.

#### ] 2.3.3 Support Brackets

Stainless steel or chromium plated. Secure to counter with stainless steel bolts. Space 4 feet on-center. Provide [stationary] [fold-down] type extending under full width of tray slide.

#### 2.3.4 Protector Shelf

Install and locate protector shelf as indicated on the drawings. Fabricate top of 14 gage thick stainless steel with all edges rolled down 180 degrees for 1.5 inches with bullnosed corners. Shelf to be minimum 10 inches wide.

#### 2.3.5 Shelf Frame

Provide one by one inch, 16 gage thick stainless steel square tubing under all edges of shelf at 30 inches on center.

#### 2.3.6 Shelf Frame Support

Form front uprights of 1.25 by 1.25 inch, 16 gage thick stainless steel tubing. Form back uprights of one by one inch, 16 gage thick stainless steel square tubing. Provide a horizontal brace, one inch above bottom of front uprights. Space front uprights 30 inches apart or less, fit with die-formed flanges to be attached to counter top from underside with bolts, and slope 10 degrees to rear.

### 2.4 PROTECTOR GLASS

0.25 inch thick, transparent [clear tempered plate glass] [heat and mar resistant clear acrylic]. Frame edges with 0.5 inch, 20 gage thick stainless steel channel. [Glass] [Acrylic] to be easily replaced in the event of [breakage] [damage]. Provide matching [glass] [acrylic] end panels. Round all free corner on 3/4 inch radius.

## 2.5 FOOD SHIELD

Provide self-serve food shield conforming to NSF/ANSI 2 constructed of 16 gauge stainless steel, with a minimum width of at least 12 inch with a full 1 inch skirt with 3/4 inch tight hem on all sides. Support on stainless steel uprights [at front] [as indicated on drawings]. Round all free corners with 3/4 inch radius.

- a. Provide adjustable louver brackets below the top fitted with 1/4 inch polished, [tempered plate glass] [heat and mar-resistant clear acrylic] framed in an all welded stainless steel channel and installed with a 7 inch clearance above counter top.
- b. Install fluorescent light fixtures the full length of the non-heated undershelf displays, with translucent protection guard. Conceal display light wiring in a corner post. Prewire fixtures to a single recess-mounted master switch per serving shelf.

## 2.6 DRIP GUTTER

Provide drip gutter as integral part of counter tops, where indicated. Provide a one inch brass drain tube centered in bottom of gutter with bottom pitched to drain. Make drip gutter 4 inches wide, one inch deep, and length indicated. Provide removable, stainless steel, die-stamped, anti-splash strainer with finger hole.

## [2.7 COLORS

[Refer to Section 09 06 00 - SCHEDULES FOR FINISHES.] [ As indicated on drawings.]

## ]PART 3 EXECUTION

### 3.1 INSTALLATION,

Install as specified in Section 11 05 40 COMMON WORK RESULTS FOR FOODSERVICE EQUIPMENT.

### 3.2 MANUFACTURER'S FIELD SERVICES

As specified in Section 11 05 40 COMMON WORK RESULTS FOR FOODSERVICE EQUIPMENT.

-- End of Section --

## SECTION 12 35 70

## HEALTHCARE CASEWORK

08/16, CHG 2: 11/18

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## ASTM INTERNATIONAL (ASTM)

**ASTM C920** (2018) Standard Specification for Elastomeric Joint Sealants

## CALIFORNIA AIR RESOURCES BOARD (CARB)

**CARB 93120** (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

## CSA GROUP (CSA)

**CSA Z809-08** (R2013) Sustainable Forest Management

## FOREST STEWARDSHIP COUNCIL (FSC)

**FSC STD 01 001** (2015) Principles and Criteria for Forest Stewardship

## PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

**PEFC ST 2002:2013** (2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

## SUSTAINABLE FOREST INITIATIVE (SFI)

**SFI 2015-2019** (2015) Standards, Rules for Label Use, Procedures and Guidance

## U.S. DEPARTMENT OF DEFENSE (DOD)

**MIL-STD-1691** (1994; Rev F) Construction and Material Schedule for Military Medical and Dental Facilities

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**40 CFR 770** Formaldehyde Standards for Composite Wood

## Products

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_\_]]

## SD-03 Product Data

## Casework

Recycled Content for Baked Enamel Carbon Steel Medical Casework; S

Recycled Content for Corrosion Resisting Steel Medical Casework; S

Recycled Content for Wood Core Medical Casework; S

Recycled Content for Carbon Steel Medical Casework; S

Recycled Content for Wood Core Dental Casework; S

Recycled Content for Carbon Steel Dental Casework; S

Recycled Content for Baked Enamel Carbon Steel Dental Prosthetics Casework; S

Recycled Content for Corrosion Resisting Steel Dental Prosthetics Casework; S

Recycled Content for Corrosion Resisting Steel Countertops; S

Recycled Wood Content for Plastic Laminate Countertops; S

## SD-04 Samples

Casework; G[, [\_\_\_\_\_]]

Wall Hung Cabinets; G[, [\_\_\_\_\_]]

Floor Mounted Cabinets; G[, [\_\_\_\_\_]]

Countertops; G[, [\_\_\_\_\_]]

Laminated Plastic Sheets; G[, [\_\_\_\_\_]]

## SD-07 Certificates

Certified Sustainably Harvested Wood for Medical Casework; S

Certified Sustainably Harvested Wood for Countertops; S



Indoor Air Quality for Composite Wood and Agrifiber Products Used  
In Countertops; S

SD-08 Manufacturer's Instructions

Installation

1.3 CERTIFICATIONS

1.3.1 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by FSC STD 01 001[, ATFS STANDARDS, CSA Z809-08, SFI 2015-2019, or other third party program certified by PEFC ST 2002:2013]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

[1.3.2 Indoor Air Quality Certification

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Provide products certified to meet requirements of both 40 CFR 770 and CARB 93120. Provide current product certification documentation from certification body.

]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver casework to the jobsite in the original individual containers, complete with screws, keys, and instructions. Mark each container with the manufacturer's name and catalog number. Store casework in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Handle casework carefully to prevent damage to the surfaces. Replace damaged items that cannot be restored to like-new condition.

PART 2 PRODUCTS

2.1 CASEWORK

Submit for approval Drawings showing layout of casework at 3/4 inch equals one foot scale. Indicate details of construction and rough-in requirements. Indicate whether cabinets are metal or wood, whether countertop is corrosion-resisting steel or plastic laminate, and whether sink is coated with [modified epoxy resin] [polypropylene] [polyethylene] or corrosion-resisting steel. All wood products must be formaldehyde free. Verify job condition affecting the work and obtain accurate field measurements for incorporation into drawings. Locate structural members, required utilities and services provided by other sections of this specification. Submit details and information necessary for fabrication and installation, manufacturer's printed data, catalog cuts, and instructions for installation and cleaning. Provide casework as scheduled on the detail drawings. Factory fabricate of manufacturer's standard sizes and finishes and conform to MIL-STD-1691, and the requirements specified below. Supplementary ordering data are as follows: [\_\_\_\_\_]. Casework items are identified on drawings with numbers preceded by the letters "C" and "D". These numbers are Joint Schedule Numbers in MIL-STD-1691. [

Provide material finish and color [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [\_\_\_\_].]

#### 2.1.1.1 Medical Casework

Provide medical casework of [baked enamel carbon steel] [corrosion resisting steel] [wood core or carbon steel covered with laminated plastic sheets]. Color of finish [\_\_\_\_] [in accordance with color schedule as indicated] [selected by the Contracting Officer from the manufacturer's standard colors].

##### 2.1.1.1.1 Recycled Content

[Baked enamel carbon steel must contain a minimum of [40] [\_\_\_\_] percent recycled content. Provide data identifying percentage of [recycled content for baked enamel carbon steel medical casework.](#)] [Corrosion resisting steel must contain a minimum of [40] [\_\_\_\_] percent recycled content. Provide data identifying percentage of [recycled content for corrosion resisting steel medical casework.](#)] [Wood core must contain a minimum of [50] [\_\_\_\_] percent recycled content. Provide data identifying percentage of [recycled content for wood core medical casework.](#)] [Carbon steel covered with laminated plastic sheets must contain a minimum of [40] [\_\_\_\_] recycled content. Provide data identifying percentage of [recycled content for carbon steel medical casework.](#)]

##### 2.1.1.1.2 Sustainably Harvested Wood

Wood materials must contain a minimum of [50] [\_\_\_\_] percent wood that is certified sustainably harvested. Provide documentation that [certified sustainably harvested wood for medical casework](#) is used and identify percentage.

#### 2.1.2 Dental Casework

Provide dental operator casework of [wood core] [carbon steel] covered with [laminated plastic sheets](#). Pattern, color and finish of decorative laminated plastic for exteriors of casework [\_\_\_\_] [in accordance with color schedule as indicated] [selected by the Contracting Officer from the manufacturer's standard [color] [woodgrain] samples].

Wood core covered laminated plastic sheets must contain a minimum of [50] [\_\_\_\_] percent recycled wood content. Provide data identifying percentage of [recycled content for wood core dental casework.](#)] [Carbon steel covered laminated plastic sheets must contain a minimum of [40] [\_\_\_\_] percent recycled steel content. Provide data identifying percentage of [recycled content for carbon steel dental casework.](#)]

#### 2.1.3 Dental Prosthetics Casework

Provide dental prosthetics casework of [baked enamel carbon steel] [corrosion resisting steel]. Color of finish [\_\_\_\_] [in accordance with color schedule as indicated] [selected by the Contracting Officer from the manufacturer's standard colors].

Baked enamel carbon steel must contain a minimum of [40] [\_\_\_\_] percent recycled steel content. Provide data identifying percentage of [recycled content for baked enamel carbon steel dental prosthetics casework.](#)] [Corrosion resisting steel must contain a minimum of [40] [\_\_\_\_] percent recycled steel content. Provide data identifying percentage of [recycled](#)

content for corrosion resisting steel dental prosthetics casework.]

2.1.4 Countertops

Provide countertops of [corrosion-resisting steel] [plastic laminate covered plywood] [plastic laminate covered particleboard] [modified epoxy resin] [or] [resin coated laminated pressed wood fiber]. In lieu of individual samples, complete minimum size casework may be submitted as samples. Mock-up units are not acceptable. Provide samples of sufficient size to show color, pattern, and method of assembly. Some requirements are:

Countertop and backsplash	One section, containing both
Door and drawer front	One of each, with hardware mounted
Melamine plastic color samples	approx 2 X 3 inch size
Stain/color samples	approx 2 by 3 inch size

[2.1.4.1 Recycled Content

[Corrosion-resisting steel must have a minimum of [40] [\_\_\_\_\_] percent recycled steel content. Provide data identifying percentage of recycled content for corrosion resisting steel countertops.] [Plastic Laminate (plywood or particleboard) must have a minimum of [50] [\_\_\_\_\_] percent recycled wood content. Provide data identifying percentage of recycled wood content for plastic laminate countertops.]

]2.1.4.2 Sustainably Harvested Wood

Wood materials must contain a minimum of [50] [\_\_\_\_\_] percent wood that is certified sustainably harvested. Provide documentation that certified sustainably harvested wood for countertops is used and identify percentage.

2.1.4.3 Indoor Air Quality Requirements

Provide certification of indoor air quality for composite wood and agrifiber products used in countertops.

2.2 PLUMBING FIXTURES

Provide faucet, trap and drain fittings, gas, air and vacuum cocks as required. Provide connection conforming to the requirements specified in Section 22 00 70 PLUMBING, HEALTHCARE FACILITIES.

PART 3 EXECUTION

3.1 INSTALLATION

Install casework in a manner that does not damage the work of other trades. Secure the casework in place in true alignment, level, and plumb. Secure units with screws through backs to cleats that have been anchored to building structure with toggle or expansion bolts.

Do not install building construction materials that show visual evidence of biological growth.

### 3.1.1 Wall Hung Cabinets

Install wall-hung cabinets to support the weight of the cabinets plus the normally expected weight of the contents of the cabinets. Space fasteners 12 inch on center using at least three bolts in each 3 or 4 foot unit width. Join adjacent cabinets in an assembly together at top and bottom with inconspicuous bolts or clips. Seal joints between the casework and wall surfaces which are not larger than the joints between casework sections with sealant conforming to ASTM C920, Type M, Grade NS, Class 25, Use NT. Close larger joints with filler strips of the same material and finish as adjacent casework. Cut filler strips to the contour of the wall surface and secure to the casework with concealed nails or screws. Use filler strips no wider than 6 inch.

### 3.1.2 Floor Mounted Cabinets

Set floor-mounted metal cabinets on a common metal base or integral base, in assemblies up to 6 feet in length in rooms having concrete or resilient flooring. Bolt cabinets to bases at cabinet corners. Face metal bases with resilient material to match wall base in space where the cabinets are located. Fasten together adjoining cabinets at top and bottom of front and back with bolts placed inconspicuously inside cabinets. Set metal cabinets in rooms having terrazzo or ceramic-tile floors on concrete or masonry bases with exposed faces finished the same as other bases in the room. Seal flush openings between cabinet and wall surfaces, due to irregularity of surfaces, with Type S or M, Grade NS, Class 12.5, use NT, conforming to ASTM C920. Close exposed-to-view openings larger than joints in tile work with filler or scribing strip of the same material and finish as adjacent casework. Cut filler to contour of wall surface and secure to casework with concealed sheet-metal screws. Use minimum width and number of fillers consistent with need and do not use filler exceeding 6 inch in width.

### 3.1.3 Countertops

Height of counter tops as indicated. Where required, provide toe space at front of cabinets by installing front face of cabinets 3 inch in front of face of base. Where toe space is not required, face of base and cabinets must be flush. Bases must have a height of approximately 4 inch. Install all items as required for proper operation in accordance with the manufacturer's directions.

## 3.2 INSPECTION AND CLEANING

Inspect placed items for proper location, fastening, connection to utilities, operation, and for damage which may have occurred during installation. Put each item into service to prove proper operation. Correct defects disclosed during inspection. Clean cabinets and countertops in accordance with manufacturer's instructions.

-- End of Section --

## SECTION 12 48 13

## ENTRANCE FLOOR MATS AND FRAMES

08/17

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

**ASTM B221** (2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

**ASTM D2047** (2017) Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

**ASTM E648** (2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

**36 CFR 1191** Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

## 1.2 SUSTAINABILITY REPORTING

Materials in this technical specification may increase contract compliance with sustainability requirements.

## 1.2.1 EPA Comprehensive Procurement Guidelines

See Section **01 33 29** SUSTAINABILITY REPORTING for requirements associated with EPA-designated products.

## 1.2.2 USDA Biobased

See Section **01 33 29** SUSTAINABILITY REPORTING for requirements associated with USDA Biobased products.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section **01 33 00** SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Installation Drawings; G[, [\_\_\_\_]]

Detail Drawings; G[, [\_\_\_\_]]

Custom Graphics Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

Entrance Floor Mats and Frames; G[, [\_\_\_\_]]

Adhesives and Concrete Primers; G[, [\_\_\_\_]]

### SD-04 Samples

Entrance Floor Mats and Frames; G[, [\_\_\_\_]]

Custom Graphics; G[, [\_\_\_\_]]

### SD-08 Manufacturer's Instructions

Manufacturer's Instructions

### SD-10 Operation and Maintenance Data

Protection, Maintenance, and Repair Information

## 1.4 QUALITY CONTROL

Comply with **36 CFR 1191** Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines for installed entrance floor mats and frames. Ensure that entrance floor mats and frames are slip-resistant in accordance with **ASTM D2047**, with a minimum 0.60 coefficient of friction, for accessible routes and are structurally capable of withstanding a [uniform floor load of 300 lb/sq ft] [wheel load of 350 lb/wheel]. Ensure that flammability is in accordance with **ASTM E648**, Class 1, Critical Radiant Flux, minimum 0.45 watts/square meter.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in their original packages or containers bearing labels clearly identifying the manufacturer, brand name, and quality or grade.

Store materials in their original unbroken packages or containers in the area in which they will be installed. Unwrap, inspect, and place mats at indicated locations. Remove all excess packing materials.

## PART 2 PRODUCTS

### 2.1 MANUFACTURED UNITS

#### 2.1.1 Entrance Floor Mats and Frames

Submit the manufacturer's catalog data. Submit samples of assembled sections of floor mats showing corners, intersections, and other details of

construction. Submit samples of [custom graphics](#), exposed floor mats, frame finishes and accessories.

#### 2.1.1.1 Resilient-Link Mats

Provide [\[rubber\]](#) [\[vinyl\]](#) [\[rubber-tire\]](#) resilient-link mats, [\[3/8\]](#) [\[7/16\]](#) inch thick with [\[galvanized-spring\]](#) [\[stainless\]](#) steel wire link rods. Ensure that nosing is vulcanized and [\[beveled for surface installation extending approximately 2 inches around the perimeter\]](#) [\[square for recess or mats butted one to another\]](#). Provide mats with steel-reinforced end trim that is [\[close-weave with link openings of 1/16 inch by 1/2 inch\]](#) [\[open-weave with link openings of 1 1/2 inches by 1/2 inch\]](#).

#### 2.1.1.2 [Rubber] [Vinyl] Mats

Provide mats [\[1/4\]](#) [\[3/8\]](#) [\[1/16\]](#) [\[\\_\\_\\_\\_\\_\]](#) inches thick with [\[square edges for recessed installations\]](#) [\[beveled edges for surface applications\]](#). Provide mats with [\[solid sheet \(no perforations\) style\]](#) [\[perforated style, 1/4-inch diameter on standard spacing\]](#) [\[perforated style, 3/16 inch by 3/4 inch on standard spacing\]](#) [\[standard pyramid design with knob back\]](#) [\[standard wide-wale corrugated\]](#) [\[hi-rib, narrow-wale corrugated\]](#) top profile and [\[low-rib, narrow-wale corrugated\]](#) [\[standard knob-base\]](#) [\[flat-base\]](#) bottom surface. Ensure that mats are made of a nonslip prime-quality compound free of calendaring and curing defects, and resistant to weather aging and ozone in normal concentrations.

#### 2.1.1.3 Coco Mats

Provide coco brush mats made of high-quality coir yarn from coconut husk fibers. Secure mats with a heavy-duty vinyl backing, woven tightly together and securely bound around the perimeter with matching coir yarn rope. Overall thickness is [\[5/8 inch\]](#) [\[3/4 inch\]](#) [\[1 inch\]](#) [\[1 1/4 inches\]](#).

#### 2.1.1.4 Recycled Rubber Tire [Tiles] [Mats]

Provide recycled rubber tire [\[tiles\]](#) [\[mats\]](#) that are made from recycled truck, bus and aircraft tires, with sidewall cords and are buffed to a chenille finish. Ensure that the [\[tiles\]](#) [\[mats\]](#) are bonded to a woven flexible backing to form [3/8- to 7/16- inch-thick](#) [\[12-inch -wide tiles\]](#) [\[12-inch-wide rolls up to 25 feet long\]](#).

#### 2.1.1.5 Carpet-Type Mats

Provide a [\[nylon\]](#) [\[polypropylene\]](#) [\[olefin\]](#) [\[polyester\]](#) [\[\\_\\_\\_\\_\\_\]](#) carpet bonded to a [1/8-inch to 1/4-inch-thick](#), flexible vinyl backing to form mats that are [\[3/8\]](#) [\[7/16\]](#) inch thick with nonraveling edges.

#### 2.1.1.6 Loop Filament Mats

Provide loop filament vinyl material [\[3/8\]](#) [\[1/2\]](#) inch thick, with [\[solid vinyl sheet\]](#) [\[foam sheet\]](#) backing. Ensure that chemical agents are built into the backing to reduce fungus and mildew.

#### 2.1.1.7 Roll-Up Mats

Provide roll-up mats with [\[mill finish\]](#) [\[\[clear\]](#) [\[bronze\]\]](#) [\[black\]](#) [\[anodized\]](#) [\[\\_\\_\\_\\_\\_\]](#) aluminum tread rails spaced a maximum [2 inches](#) on center and running counter to the traffic flow. Ensure that the mats must allow debris to fall to subfloor. Ensure that tread rails are connected by

[aluminum] [vinyl] hinges and include [an aluminum] [a vinyl] edge around the perimeter and a continuous vinyl cushion.

Provide [recessed] [surface] mats mounted with [carpet consisting of nylon or polypropylene carpet fibers fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Carpet has antistatic and antistain treatments] [carpet/bristle filament mix] [vinyl] [abrasive tape] [poured abrasive] [recycled rubber] [serrated aluminum] [\_\_\_\_\_] inserts.

#### 2.1.1.8 Floor Grids

Provide a floor grid consisting of a series of [aluminum] [bronze] tread rails spaced [1 1/2] [\_\_\_\_\_] inches on center and running counter to the traffic flow. Ensure that floor grids allow debris to fall to the subfloor. Provide a [drain pan] [trench drain] [\_\_\_\_\_] deep. Rest grid assemblies on a continuous vinyl cushion mounted to each continuous foot at [\_\_\_\_\_] on center. [Ensure that pits are [\_\_\_\_\_] deep and rest on a continuous vinyl cushion with additional support members [\_\_\_\_\_] on center, including adjustable support legs.] [Provide a drain pan to include a drain and a stainless-steel strainer.] For a [stainless-steel grid, provide satin-finished stainless-steel rails [\_\_\_\_\_] apart, electronically welded joints, and a stainless-steel frame [\_\_\_\_\_] deep.] Provide all anchors, fasteners, accessories, and other parts required for a complete installation.

#### 2.1.1.9 Frames

[Provide surface-mounted frames that have a tapered flexible vinyl edge at least [2] [1 1/2] inches wide, with welded corners and attached to the mat at all four edges.] [Ensure that surface-mounted frames are tapered, at least [2] [1 1/2] inches wide, screwed into an opening in the floor to create an opening for the mat to sit in.] [Provide recessed frames in extruded aluminum Alloy 6061-T6 or Alloy 6063-T5 ASTM B221. Ensure that the frame depth accommodates the mat and system specified.] Frame color is [mill finish] [clear] [black] [[light] [medium] [dark] bronze] [\_\_\_\_\_]. Ensure that edge-frame members are fabricated in single lengths or with the fewest pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins. Ensure that any concealed surfaces of aluminum frames that contact cementous material are coated with the manufacturer's standard protective coating. Ensure that frames include accessories and devices required for a complete installation.

#### 2.1.1.10 Tread Insert Options

Provide tread inserts consisting of [carpet composed of solution-dyed nylon or polypropylene carpet fibers fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths; carpet has antistatic and antistain treatments. Ensure that pile weight is a minimum 30 ounces per square yard] [carpet/bristle filament mix] [vinyl] [abrasive tape] [poured abrasive] [recycled rubber] [serrated aluminum] [\_\_\_\_\_].

#### 2.1.2 Adhesives and Concrete Primers

Provide adhesives and concrete primers, where required, according to the manufacturer's recommendations.

#### 2.1.3 Graphics



Clearly illustrate details in drawing of custom graphic [emblem]  
[logo] [design].

#### 2.1.4 Color and Size

Ensure that color is in accordance with [Section 09 06 00 SCHEDULES FOR FINISHES] [the drawings] [\_\_\_\_\_]. Ensure that the size of mat is [\_\_\_\_\_] [as indicated].

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Comply with the manufacturer's requirements for substrates and floor conditions affecting installation of floor mats and frames. Ensure that all unsatisfactory conditions have been corrected before installation.

#### 3.2 INSTALLATION

Submit [detail drawings](#), and [custom graphics drawings](#) as required. Provide [installation drawings](#). Provide the manufacturer's [protection, maintenance, and repair information](#).

Install floor mats and frames according to [manufacturer's instructions](#). Set mat tops at the height recommended by the manufacturer for the most effective cleaning action. Provide clearance between bottoms of doors and tops of mats. [Coordinate recess frame installation with concrete construction to ensure that frame anchorage is correct and that the base is level and flat. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.]

-- End of Section --

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## SECTION 12 50 00.13 10

## FURNITURE AND FURNITURE INSTALLATION

08/17, CHG 1: 11/18

## PART 1 GENERAL

Purchase and install furniture as identified within this specification. This specification section includes a Furniture, Fixtures and Equipment (FF&E) Package attachment. [

The requirements of this specification also apply to systems furniture unless otherwise specified in Section 12 59 00 Systems Furniture.]

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-6 2021; Addenda AS-BF 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM D4157 (2013; R 2017) Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)

ASTM E 1537 (2016) Standard Test Method for Fire Testing of Upholstered Furniture

ASTM E 1590 (2017) Standard Test Method for Fire Testing of Mattresses

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

BIFMA INTERNATIONAL (BIFMA)

ANSI/BIFMA X5.1 (2017) American National Standards For Office Furnishings - General Purpose Office Chairs

ANSI/BIFMA X5.3 (2007; R2012) American National Standards For Office Furnishings - Vertical Files

ANSI/BIFMA X5.4 (2012) American National Standards For Office Furnishings - Lounge Seating

ANSI/BIFMA X5.5 (2014) American National Standards For Office Furnishings -Desk Products

ANSI/BIFMA X5.6 (2016) American National Standards For Office Furnishings -Panel Systems

ANSI/BIFMA X5.9 (2012) American National Standards For Office Furnishings - Storage Units

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2021) Life Safety Code

NFPA 260 (2013) Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture

NFPA 265 (2019) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

STATE OF CALIFORNIA DEPARTMENT OF CONSUMER AFFAIRS, BUREAU OF ELECTRICAL AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION (BEARHFTI)

TB 117-2013 (2013) Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture

TB 133 (1991) Flammability Test Procedure for Seating Furniture in Public Occupancies

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568.2 (2018d) Balanced Twisted-Pair Telecommunications Cabling and Components Standards

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1632 Standard for the Flammability of Mattresses and Mattress Pads (FF 4-72 Amended)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL 723 (2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Storage Location; G[, [\_\_\_\_\_]]

## SD-02 Shop Drawings

Installation Drawings; G[, [\_\_\_\_\_]]

[Grommet[, Power and Communication Units][, and Wire Management] Locations; G[, [\_\_\_\_\_]]

## SD-03 Product Data

Product Data; G[, [\_\_\_\_\_]]

Product Style Options; G[, [\_\_\_\_\_]]

## SD-04 Samples

Fabric and Finishes; G[, [\_\_\_\_\_]]

## SD-07 Certificates

Authorized Dealer; G[, [\_\_\_\_\_]]

Certified Furniture Installers; G[, [\_\_\_\_\_]]

Licensed Electrician; G[, [\_\_\_\_\_]]

Certified Telecommunications Installer; G[, [\_\_\_\_\_]]

Manufacturer's Certification; G[, [\_\_\_\_\_]]

Warranty; G[, [\_\_\_\_\_]]

## SD-10 Operation and Maintenance Data

Furniture, Data Package 1; G[, [\_\_\_\_\_]]

## SD-11 Closeout Submittals

Energy Efficient Equipment; S

Reduced VOC's for Furniture; S

Recycled Content of Furniture; S

Bio-Based Content of Furniture; S

## 1.3 SERVICES

Provide services to include furniture purchase, field measuring, installation drawings, shipping and delivery coordination, receiving, inspection, submitting and processing freight and warranty claims, unpacking, storing, assembly, installation and other related activities or tasks for a complete and functional installation. Reference Section 01 45 00.00 10 QUALITY CONTROL for inspection requirements. The Contracting Officer must be allowed to participate in inspections. [ In addition provide services for existing furniture as specified, reference paragraph on EXISTING FURNITURE for more information.] Develop project timelines and establish shipping, receiving and installation dates that coordinate with the building construction schedule. Hold at a minimum weekly team meetings to brief the project team, include the Contracting Officer. Notify the Contracting Officer immediately of any scheduling problems, discontinued furniture items including fabrics and finishes, or other conditions which may cause delays, and recommend available substitutes, solutions, and provide updated timeline to coordinate with building construction schedule. Substitutes and solutions must comply with the specification and be approved by the Contracting Officer.

#### 1.4 FURNITURE PURCHASE

Purchase furniture, including checking accuracy of all acknowledgements and schedules from manufacturers and making necessary corrections to insure that the manufacturer has a correct understanding of the order and requirement. [ Provide furniture from the GSA Schedules and provide GSA pricing. Provide furniture from open market only when an item is not available on the GSA Schedules. See FAR clause 52.251-1 Government Supply Sources.] [ Purchase furniture from the open market. The furniture provided needs to be available on the GSA Schedules to assist the User with future purchases. GSA information is provided FOR INFORMATIONAL PURPOSES ONLY. It is encouraged to solicit and provide GSA pricing on furniture.] Compete the furniture purchase by obtaining a minimum of (3) separate proposals. Furniture is subject to FAR clause 52.236-5 Materials and Workmanship. [ If necessary to meet project timeline requirements, furniture may be purchased using manufacturers quick-ship programs or by coordinating factory times.]

#### 1.5 ALTERNATE DESIGN

When a manufacturer's product is unable to provide desk and workstation configurations and filing/storage that conform exactly to the furniture layouts shown in the contract drawings and specifications, alternate designs may be submitted for consideration by the Contracting Officer. Alternate designs must meet or exceed the following criteria. Alternate designs that are submitted but do not meet these criteria will be rejected.

##### 1.5.1 Desk and Workstation Size and Configuration

The alternate design must provide desks and workstations of the same basic size and configuration shown, with only the sizes of the individual components within the desk and workstation changed to meet the standard product of the manufacturer.

##### 1.5.2 Filing and Storage Size and Configuration

The alternate design must provide filing and storage of the same basic size and configuration shown, with only the size changed to meet the standard product of the manufacturer. The storage capacity must not be reduced.

### 1.5.3 Furniture Requirements

The furniture provided must comply with the drawings, specifications, and the requirements identified in the FF&E Package Attachment.

### 1.5.4 Layout

The storage capacity, number of desks and workstations, number of persons accommodated, width of aisles, and functionality must be maintained. Layout must comply with [NFPA 101](#) and [36 CFR 1191](#).

### 1.6 [AUTHORIZED DEALER, CERTIFIED FURNITURE INSTALLERS, LICENSED ELECTRICIAN AND CERTIFIED TELECOMMUNICATIONS INSTALLER](#)

When required by the furniture manufacturer, furniture must be installed by an authorized dealer and a certified furniture installation crew must be used on the project. [ Services provided to reuse existing furniture must comply with manufactures warranty requirements to maintain warranty. If warranty for existing furniture to be reused has expired, services must be completed by a furniture installation crew with a minimum of 5 years experience.] All furniture requiring hardwiring must be completed by a licensed electrician. Communications installers must be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level or have a minimum of [3] [\_\_\_\_\_] years experience in the installation of the specified cables and components. All installers, furniture, electrical and communications, must be on-site if questions arise. Submit copies of authorized dealer, furniture installation crew, licensed electrician and certified telecommunications installer certifications.

### 1.7 DELIVERY, STORAGE AND HANDLING

#### 1.7.1 Delivery

Deliver furniture to the jobsite in manufacturer's original packaging or blanket wrapping. Original packaging must be marked with the manufacturer name, item identification, and project reference clearly marked.

#### 1.7.2 Furniture Inspection

Inspect furniture and provide notification of damage within the time frame required by the shipping company while carrier is still on-site. Complete claims for concealed damage within the time frame required by the shipping company and furniture manufacturer. A claim file must be maintained that documents each claim. Forward copies of claims to the Contracting Officer on a [daily] [\_\_\_\_\_] basis.

#### 1.7.3 Storage

Storage space is not available on-site and furniture must be stored at an off site location. Provide any storage space required for furniture and transport stored furniture to the project site for installation. [Storage location](#) must be approved by the Contracting Officer at the time of the furniture order. If storage is required, furniture must be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, in a manner that permits easy access for inspection and handling, and in an environment in accordance with furniture manufacturers instructions.

#### 1.7.4 Furniture Staging Area

Coordinate location of the furniture staging area with the Contracting Officer.

#### 1.8 WARRANTY

Provide manufacturer performance guarantees or warranties for single-shift service and include parts, labor and transportation as follows, unless otherwise noted:

- a. Systems Furniture - [see Section 12 59 00 Systems Furniture] [12 year minimum] [lifetime]
- b. Desks and Workstations - 12 year minimum
- c. Filing and Storage - 12 year minimum
- d. Seating
  - (1) Seating, unless otherwise noted - 10 year minimum
  - (2) 24/7 Seating (multiple shift use) - 10 year minimum
  - (3) Seating Mechanisms and Pneumatic Cylinders - 10 year minimum
  - (4) Lounge Seating - 10 year minimum
  - (5) Stacking Chairs - 10 year minimum
- e. Tables
  - (1) Unless otherwise noted - 10 year minimum
  - (2) Table Mechanisms - 5 year minimum
  - (3) Table Ganging Device - 1 year minimum
- f. Miscellaneous
  - (1) Fabric - 3 year minimum
  - (2) LED Task Lighting - 5 year minimum
  - (3) Task Lighting - [2] [3] [\_\_\_\_\_] year minimum

Provide items not listed with a 1 year minimum. When manufacturers standard performance guarantees or warranties exceed the minimum requirements identified, provide the standard performance guarantee or warranty. Submit manufacturer's warranty information for all furniture items.

## PART 2 PRODUCTS

### 2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:



### 2.1.1 Energy Efficient Equipment

Coordinate requirement for energy efficient equipment, such as appliances and lighting, and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph ENERGY EFFICIENT EQUIPMENT.

### 2.1.2 Reduced VOC's for Furniture

Coordinate requirement for reduced VOC requirements for furniture and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

### 2.1.3 Recycled Content of Furniture

Coordinate requirement for recycled content for furniture and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph RECYCLED CONTENT.

### 2.1.4 Bio-Based Content of Furniture

Coordinate requirement for biobased content for furniture and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING paragraph BIO-BASED PRODUCTS.

## 2.2 REFERENCE TO MANUFACTURER NAMES AND COLORS

Where product and color is shown as being specific to one manufacturer in the FF&E Package Attachment, an equivalent color or product by another manufacturer may be submitted for approval. Manufacturers, style lines, model numbers, finish, and fabric information are provided to establish design intent and are not intended to limit the selection of equal products and colors from other manufacturers.

## 2.3 FURNITURE REQUIREMENTS

Use the FF&E Package Attachment in conjunction with the drawings and specifications for the furniture requirements. [ Systems furniture is specified in Section 12 59 00 SYSTEMS FURNITURE.] Provide furniture from manufacturer's standard product as shown in the most current published price list or amendment. Furniture provided must be part of current line as indicated with no intent to discontinue within two years. Provide furniture that is intended for commercial use not residential. submit **product data** for all furniture items, to include catalog cuts, brochures, product information, and other necessary literature to indicate compliance with specifications. [ Provide product data for all items together in a single submittal.] [ Provide product data for all similar types of items together as a group, such as [desks/workstations,] [seating,] [storage,] [tables,] and [\_\_\_\_\_]. Submit each grouping of similar type items in a single submittal.] When applicable, include GSA schedule information to confirm that items are available on GSA schedule. Tag product data sheets with applicable furniture item code and name. Submit data for all **product style options** for selection when options are available. This applies to but is not limited to furniture items that have options such as edge details, hardware options, and grommet colors. Submit **manufacturer's certification** stating that furniture meets the specifications. [

### 2.3.1 EXISTING FURNITURE (GOVERNMENT FURNISHED/CONTRACTOR INSTALLED-GF/CI)

## 2.3.1.1 Existing Furniture to be Reused

Disassemble, pack, move, store, transport to the project site and install existing furniture identified to be reused. This includes disconnecting and reconnecting furniture electrical connections at the building source. Coordinate with electrician for safe terminations or removal of disconnected building electric system supply circuits.

## [2.3.1.2 Existing Furniture that is Not Reused

[Disassemble and have ready for excessing and pick up any furniture identified as not to be reused. Furniture will be picked up by Government directed vendors. Coordinate pick-up times with Contracting Officer and User.] [Disassemble and relocate any furniture identified as not to be reused to the [Defense Logistics Agency Disposition Services (DLADS)] [\_\_\_\_\_] facility.] This includes disconnecting furniture electrical connections at the building source. Coordinate with electrician for safe terminations or removal of disconnected building electric system supply circuits. Protect all items from damage and provide security and weather protection prior to and during [ pickup] [ relocation].

## ] [2.3.1.3 Existing Furniture Communications

Remove existing Information Technology (IT) cables (i.e. SIPRNET, NIPRNET, J-WIC'S, etc.) and telephone wiring from existing furniture systems identified to be reused or requiring excessing.

## ]]2.3.2 Construction

a. Provide furniture that complies with the following testing requirements:

## (1) ANSI/BIFMA

[ (a) Office Seating - ANSI/BIFMA X5.1

] [ (b) Vertical Files - ANSI/BIFMA X5.3

] [ (c) Lounge Seating - ANSI/BIFMA X5.4

] [ (d) Desk Products - ANSI/BIFMA X5.5

] [ (e) Panel Systems - ANSI/BIFMA X5.6

] [ (f) Storage - ANSI/BIFMA X5.9]

## (2) Flammability

[ (a) Systems furniture and workstation panel components must meet requirements for flame spread and smoke development as specified by NFPA 101 except as follows. Conduct testing in accordance with either ASTM E84 or UL 723 on the entire assembled panel of the worst case (most combustible) combination of fabric and interior construction. In addition, fabric must meet the requirements of NFPA 265. Do not exceed panel flame spread [25 for Class A] [75 for Class B] [200 for Class C], and do not exceed panel smoke development 450 for Class A, B, and C.] [

(b) Upholstered furniture must comply with [ TB 117-2013 or NFPA 260 ] [ TB 133 or ASTM E 1537].] [

- (c) Mattresses must comply with 16 CFR 1632[ and ASTM E 1590].]
- b. Provide furniture with no rough or sharp edges or exposed connections. Clips, screws, and other construction elements must be concealed wherever possible.
- c. Items such as desks, workstations and systems furniture must include all necessary components to be structurally sound and must not be attached to the wall unless specified to be wall mounted in the contract documents.
- d. Desks, workstations, storage, and tables must have leveling devices to compensate for uneven floors.
- e. The underside of desks, workstations, and tables must be completely and smoothly finished.
- f. The backside of freestanding desks, workstations, [\_\_\_\_\_] and storage must be finished.
- g. Provide chair casters and glides appropriate for the floor material they are located on, such as carpet and resilient flooring.

#### 2.3.3 Locks and Keying

- a. All drawers and doors, including but not limited to overhead storage cabinets, storage towers, supply cabinets, storage cabinets, desk and workstation pedestals, and filing cabinets must be lockable.
- b. Key each desk and workstation in an office differently and key locks within each desk and workstation alike.
- c. Furniture storage components in private offices must be keyed alike. Key each private office differently.
- d. Provide field changeable lock cylinders in desks and workstations with a minimum of 100 different key options. Number keys and lock cylinders for ease of replacement or clearly label locks with a key number, except for those manufacturers who have removable format locks.
- e. Drawers within a pedestal must be lockable either by a central lock that controls all pedestals under one work surface or an individual keyed lock in each pedestal.
- f. Central file and storage units which are grouped together but are not a part of a workstation must be keyed [alike][differently] unless otherwise specified.
- g. Provide two keys for each workstation when components are keyed alike. Also provide two keys for each miscellaneous item such as filing cabinets, supply cabinets, storage cabinets, and similar type furniture items.
- h. Provide three copies of each master key to the Contracting Officer.[
- i. [Leave keys in locks] [Inventory keys, label keys by lock number, room number and furniture item and turn over inventory and keys to the Contracting Officer].]

#### 2.3.4 Receptacle Bodies and Device Cover Plates

Provide furniture panel faceplates and receptacle body types [and color] as specified in [FF&E Package Attachment] [12 59 00 SYSTEMS FURNITURE] [\_\_\_\_\_]. [Provide color as follows:

- a. Faceplate: [match panel trim color] [\_\_\_\_\_]
- b. Receptacle Bodies: [match panel trim color] [\_\_\_\_\_]
- c. Communication Cable Jackets: [match receptacle device cover plates in color] [\_\_\_\_\_]
- d. Isolated Ground Receptacles: [ orange] [ or] [ have distinct markings] [ be of a different color than other receptacles]

#### 2.3.5 Keyboard Tray

Provide worksurfaces that are capable of accepting an articulating keyboard tray at locations indicated. The keyboard tray must be capable of fully recessing under the work surface and extending to give the user full access to the keyboard. The keyboard tray must have height adjustability and positive and negative tilting capability and have 180-degree swing side travel rotation. The keyboard tray must have a wrist support and include a mouse pad at the same level as the keyboard that can accommodate both right and left handed users.

#### 2.3.6 Fabric and Finish

Submit samples of all furniture **fabric and finishes**. Samples must be actual samples, not photographic representations, size must be a minimum of **3 by 3 inches**. If necessary, provide larger size samples to clearly represent pattern. Label samples with fabric or finish code, furniture item code and name, manufacturer name, and color information. Fabric samples must also be labeled with fiber content and double rub testing information.

##### 2.3.6.1 Fabric

- a. Fabric must be from manufacturer's standard line [ and] [,] graded-in textile manufacturer's fabrics [, and customer's own material (COM)]. [ Do not provide COM fabrics.]
- b. Provide a mid grade fabric [, unless otherwise noted]. Example: manufacturer available grades 1 through 4 (even number of grades), provide grade 3; manufacturer available grades A through D (even number of grades), provide grade C; manufacturer available grades A through E (odd number of grades), provide grade C (middle grade).
- c. Provide a topical or inherent soil retardant treatment where indicated.
- d. [Comply with double rub testing as specified in the FF&E Package Attachment.] [Fabric for seating must comply with a minimum of [55,000] [\_\_\_\_\_] double rubs unless otherwise noted.] Perform double rub testing in accordance with the **ASTM D4157** Wyzenbeek Method.
- e. Provide vinyl, polypropylene or similar type fabric for seating only if allowed in FF&E Package Attachment.

## f. Pattern:

- (1) Provide patterned upholstery fabric to help hide soiling. Pattern is defined as follows:
  - (a) Solid Color: [textured,] [single color] [or] [pattern smaller in size than the small size pattern] [\_\_\_\_\_]
  - (b) Small Size Pattern: minimum [1/2 inch] [\_\_\_\_\_]
  - (c) Medium Size Pattern: minimum [2 inch] [\_\_\_\_\_]
  - (d) Large Size Pattern: minimum [5 inch] [\_\_\_\_\_]
- (2) Provide patterns [as specified in the FF&E Package Attachment.] [as follows]:
  - (a) Desk Chairs: [solid color] [small] [\_\_\_\_\_] size pattern
  - (b) Side or Guest Chairs: [small] [medium] [\_\_\_\_\_] size pattern
  - (c) Lounge Type Chairs: [small] [medium] [large] [\_\_\_\_\_] size pattern
  - (d) [\_\_\_\_\_]: [small] [medium] [large] [\_\_\_\_\_] size pattern

g. See FF&E Package Attachment for additional information.

## 2.3.6.2 Finishes

Provide furniture finishes as listed below unless otherwise noted:

- a. Finishes must be able to be cleaned with ordinary household cleaning solutions. Wood finishes must be able to be cleaned with damp cloth as directed by the manufacturer.
- b. The finish of steel surfaces must be the manufacturer's most durable finish such as factory powder coat or baked enamel.
- c. Grommet colors must be compatible and coordinated with desk, workstation, and table finish colors.
- [ d. Finishes must be neutral in color.
- ] [e. Plastic laminate worksurfaces and table tops must be neutral in color and must have a pattern to help hide soiling.
- ] f. See FF&E Package Attachment for additional information.

## 2.4 FURNITURE LAYOUT

Provide furniture layout as indicated.

## PART 3 EXECUTION

## 3.1 BUILDING EXAMINATION

Become familiar with details of the work, inspect all areas and conditions

under which furniture is to be installed, and coordinate scheduling of dedicated elevators and docks. Notify the Contracting Officer in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected.

### 3.2 BUILDING PROTECTION

Protect building surfaces to prevent soiling and damage during delivery and installation. Any soiling and damage that occurs to the building during the installation of furniture must be cleaned and repaired, or replaced to its original condition and must be approved by the Contracting Officer.

### 3.3 INSTALLATION

#### 3.3.1 Installation Drawings

Installation drawings must include furniture layout, critical dimensions and locations of electrical and communications. Reflect field verified conditions in furniture layouts. Drawings must be at  $1/4$  inch = 1 foot scale, unless otherwise specified. Provide typical plans and isometrics/elevations of desks and workstations at a scale of  $1/2$  inch = 1 foot. When applicable, provide desk and workstation electrical and communications locations. When applicable include controlled-circuit identification for each furniture receptacle and coordinate with the building electrical system circuits in accordance with ASHRAE 90.1 - IP. Critical dimensions include, but are not limited to clearances and aisle widths. Drawings must include layout for furniture systems workstations for coordination purposes. Label furniture with furniture item code identified in this specification. Submit grommet[, power and communication units][, and wire management] locations.

#### 3.3.2 Furniture Installation Procedures

Complete installation in accordance with manufacturer's installation instructions, assembly manuals, warranty requirements and approved installation drawings. Also comply with the following requirements:

- a. Use material handling equipment with rubber wheels.
- b. Furniture and components must be installed level, plumb, square, and with proper alignment with adjoining furniture.
- c. Match keys to locks and check locking mechanisms.
- d. Check drawers, doors, lighting, and other operable items and mechanisms for proper operation.
- e. Remove all protective wrapping tape, residue, and related type items.
- f. Securely interconnect furniture components where required.
- g. Securely attach and anchor furniture components to the building when required.
- h. Securely anchor furniture such as shelving and storage units to the building when required by the manufacturer.
- i. All items with an electrical plug, such as but not limited to task lighting and tables with electrical power, must be fully operational.

- j. All hardwired furniture, such as but not limited to furniture systems, must be fully operational. Verify that voltage is present in electrical outlets. Verify controlled-circuit outlets are properly configured in accordance with the installation drawings.
- k. Furniture must not block SIPRNET[ and ][\_\_\_\_\_] jacks or the jack enclosures on walls. Report conflicts to Contracting Officer to discuss resolution.
- l. Upon completion of installation, all furniture must be completely cleaned, finished, leveled, aligned, operational and functional.[
- m. Install artwork with security mount hardware as recommended by the manufacturer.]

### 3.3.3 Furniture Communications Installation

[Provide all Information/Technology (IT) cables (i.e. SIPRNET, NIPRNET, J-WIC'S, etc.) and phone wiring up to and including the face plate/box of all furniture as required and the services to install the cables, wiring and face plates/boxes in the furniture. Coordinate cable type, cable jacket and outlet jack color with Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM. Furniture communication installers must be on site to install communication cables, wiring and other components for furniture during furniture installation. Coordinate the TIA-568.2 pin/pair assignments for communication outlets to match the configuration of the building's non-furniture outlets; coordinate with Contracting Officer. All items with a communication interface must be fully operational.][Installation of Information/Technology (IT) wiring, cables and face plates/boxes in the furniture will be completed by others.]

### 3.4 CLEANING

Remove all packing materials and other trash from the jobsite. Upon completion of installation, all products must be clean, including inside all drawers and doors, and the area must be free of debris and left in a clean and neat condition. Any defects in or damage to furniture must be repaired or replaced and approved by the Contracting Officer. Damaged products that cannot be satisfactorily repaired must be replaced. Correct any problems with assembly and installation. Prior to any furniture repair, replacement, and/or assembly and installation corrections, protect the building surfaces.

### 3.5 OPERATION AND MAINTENANCE MANUALS

Submit the Furniture, Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and include the following:

#### 3.5.1 Assembly Manuals

Describe assembly and re-configuration procedures. Provide three sets of installation video tapes if available.

#### 3.5.2 Installation Instructions

Provide a copy of the instructions used to install the furniture. Also describe any special procedures or helpful hints learned during the installation process.

### 3.5.3 Maintenance Manuals

Describe proper cleaning and minor repair procedures, include cleaning instructions for fabrics.

### 3.5.4 Electrical System Manuals

Describe the functions, configuration, and maintenance of the furniture electrical system (power[, communication][, and data]). This information may be included in the assembly or maintenance manuals.

### 3.5.5 Special Tools

Provide [three][\_\_\_\_] sets of special tools necessary for assembly and disassembly of furniture and components from each manufacturer. Mark tool(s) with manufacturer and product information.

### 3.5.6 Furniture Drawings

Provide hard copy and electronic, showing installed furniture layout. Include all modifications. Provide electronic copies on a CD-ROM. Coordinate type (such as but not limited to Microstation, AutoCad and Revit) and version required with User. Include critical dimensions, and locations of building and furniture electrical and communications. Provide drawings at  $1/4$  inch = 1 foot scale, unless otherwise specified. Provide typical plans and isometrics/elevations of workstations at a scale of  $1/2$  inch = 1 foot. Code all furniture with furniture item code identified in this specification.

### 3.5.7 Furniture Listing

Provide complete listing, hard copy and electronic, of furniture provided. Include all modifications. Provide electronic copies on a CD-ROM. Coordinate type of electronic file required with User (such as but not limited to Word and Excel). Listing must include furniture item code and name used in FF&E Package, part/model numbers, fabrics and finishes for all components furnished. Organize listing by item name and code and provide building totals.

### 3.5.8 Order Form Documentation

Provide Order Form Documentation with Purchase Order number and project name and location to allow the User to follow up on warranty issues and help with future purchases.

### [3.5.9 Key Control System

Key Control System. Provide system in excel format; indicate lock number, room number and location of lock within rooms if more than one lock number.

]

-- End of Section --



## SECTION 12 61 13

## UPHOLSTERED AUDIENCE SEATING

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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN FOREST FOUNDATION (AFF)

**ATFS STANDARDS** (2015) American Tree Farm System Standards of Sustainability 2015-2020

## ASTM INTERNATIONAL (ASTM)

**ASTM A48/A48M** (2003; R 2021) Standard Specification for Gray Iron Castings

**ASTM A513/A513M** (2020a) Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

**ASTM A1011/A1011M** (2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

**ASTM D4157** (2013; R 2017) Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)

**ASTM F851** (1987; R 2020) Standard Test Method for Self-Rising Seat Mechanisms

## CALIFORNIA AIR RESOURCES BOARD (CARB)

**CARB Regulation** Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products

## CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

**CDPH SECTION 01350** (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

## CSA GROUP (CSA)

**CSA Z809-08** (R2013) Sustainable Forest Management

## FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship
HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)	
HPVA HP-1	(2016) American National Standard for Hardwood and Decorative Plywood
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 101	(2021) Life Safety Code
PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)	
PEFC ST 2002:2013	(2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements
STATE OF CALIFORNIA, DEPARTMENT OF CONSUMER AFFAIRS, BUREAU OF HOME FURNISHINGS AND THERMAL INSULATION (CTB)	
CTB 117-2000	Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture
CTB 117-2013	Requirements, Test Procedure and Apparatus for Smolder Resistance of Materials Used in Upholstered Furniture
SUSTAINABLE FOREST INITIATIVE (SFI)	
SFI 2015-2019	(2015) Standards, Rules for Label Use, Procedures and Guidance
U.S. DEPARTMENT OF COMMERCE (DOC)	
DOC CS 191	Commercial Standard for the Flammability of Clothing Textiles
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
16 CFR 1610	Standard for the Flammability of Clothing Textiles

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detailed Drawings; G[, [\_\_\_\_]]

## SD-03 Product Data

Seating System; G[, [\_\_\_\_]]

[ Recycled Content for upholstered audience seating; S

] [ No added Urea-formaldehyde for Composite Wood or Agrifiber Products; S

## ] SD-04 Samples

Seating System; G[, [\_\_\_\_]]

## SD-06 Test Reports

Fire Test Response Characteristics; G[, [\_\_\_\_]]

Double Rub Tests; G[, [\_\_\_\_]]

## SD-07 Certificates

[ Installer's Qualifications

] [ Certified Sustainably Harvested plywood; S

] [ Certified Sustainably Harvested solid hardwood and wood veneer; S

] Indoor Air Quality for upholstered audience seating; S

[ Indoor Air Quality for fabrics; S

] [ Indoor Air Quality for composite wood and agrifiber products; S

## ] SD-10 Operation and Maintenance Data

Assembly Manuals, Data Package 1; G[, [\_\_\_\_]]

## SD-11 Closeout Submittals

Seating System, Data Package 1; G[, [\_\_\_\_]]

Submit Data Package 1 for upholstered audience seating in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

## 1.3 CERTIFICATIONS

## [1.3.1 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by FSC STD 01 001[, ATFS STANDARDS, CSA Z809-08, SFI 2015-2019, or other third party program certified by PEFC ST 2002:2013]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable

wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

]1.3.2 Indoor Air Quality Certifications

[1.3.2.1 Seating System Products

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.

] [1.3.2.2 Fabrics

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.

] [1.3.2.3 Composite Wood or Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Provide current product certification documentation from certification body.

] [1.3.3 Installer's Qualifications

When recommended by the manufacturer, deliver and install seating by an authorized dealer with a certified installation crew. Complete all hardwiring by a licensed electrician.

]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver components to the site in unopened containers clearly labeled with the manufacturer's name and container contents. Store materials in a safe, dry, and clean, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, maintained at a temperature above 60 degrees F for 2 days prior to installation. Do not s with materials which have high emissions of volatile organic compounds (VOC's) or other contaminants, including [\_\_\_\_]. Do not store seating near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Handle the items in a manner that will protect the materials from damage.

1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for specified warranty periods from date of final acceptance of the work as follows:

1.5.1 Warranty Periods

- a. Structural: [5 years] [10 years] [\_\_\_\_]
- b. Plastic, Wood and Paint Components: [3 years] [\_\_\_\_]

- [ c. Electrical Components: [5 years] [\_\_\_\_\_] ]  
]d. Operating Mechanism: [5 years] [\_\_\_\_\_] ]  
] e. Fabric: [1 year] [3 years] [\_\_\_\_\_] ]

## PART 2 PRODUCTS

### 2.1 MATERIALS

[Provide Upholstered Audience Seating with a minimum of 20 percent recycled content. Provide data identifying percentage of [recycled content for upholstered audience seating.](#)]

[Provide certification of [indoor air quality for Upholstered Audience Seating.](#)]

### 2.2 PERFORMANCE REQUIREMENTS

#### 2.2.1 [Fire Test Response Characteristics](#)

##### 2.2.1.1 Fabric and Padding

Provide fabric that is flame and smolder ignition resistant, and self-extinguishing, Class 1 fabric according to [DOC CS 191](#) or [16 CFR 1610](#), as applicable per authorities having jurisdiction, tested according to California Technical Bulletin [CTB 117-2000](#). Provide padding that complies with California Technical Bulletin [CTB 117-2000](#). Provide fabric and padding that comply with [NFPA 101](#).

##### [2.2.1.2 Upholstery Assembly

Comply with component-testing requirements of California Technical Bulletin [CTB 117-2013](#).

### ]2.3 MATERIALS

#### 2.3.1 Upholstery Fabric

Provide fabric meeting specified fire test response characteristics which is a [plain] [decorative] [\_\_\_\_\_] weave, fiber content of [100 percent polypropylene] [100 percent polyester] [100 percent nylon] [\_\_\_\_\_] treated to resist staining and soiling. Provide fabric upholstery for seating with [minimum [55,000] [75,000] [\_\_\_\_\_] [double rub tests](#) according to [ASTM D4157](#).]

[Provide fabrics meeting emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type). Provide certification of [indoor air quality for fabrics.](#)]

#### 2.3.2 Polyurethane Foam Padding

Provide polyurethane foam padding meeting specified fire test response characteristics which is nonhardening, non-oxidizing and has a high resistance to alkalies, oils, grease, soaps, abrasions, moisture, mildew, and tearing.

#### 2.3.3 Sub Title

Provide plywood conforming to **HPVA HP-1**, made of hardwood and of crossbanded construction. Provide face veneers for exposed surfaces of Grade A hardwood, vertical grain, [maple] [oak] [cherry] [\_\_\_\_\_] with manufacturer's standard finish. Provide unexposed veneers of sound grade hardwood or Grade A fir.

[Provide [certified sustainably harvested plywood](#).]

#### 2.3.4 Solid Hardwood and Wood Veneer

Provide solid hardwood and wood veneer of first grade [maple] [oak] [cherry] [\_\_\_\_\_] . Finish exposed wood with manufacturers standard finish.

[Provide [certified sustainably harvested solid hardwood and wood veneer](#).]

#### 2.3.5 Composite Wood or Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores.

Provide products containing no added urea-formaldehyde resins. Provide current product literature showing [no added urea-formaldehyde for composite wood or agrifiber products](#).

[Provide products certified to meet emissions requirements of either **CARB Regulation** or **CDPH SECTION 01350** (limit requirements for either office or classroom spaces regardless of space type). Provide certification of [indoor air quality for Composite wood and agrifiber products](#).]

#### 2.3.6 Plastic Laminate

Plastic laminate conforms to **ANSI/NEMA LD 3**, Horizontal General Purpose Standard (HGS) Grade, 0.048 inches (plus or minus 0.005 inches) in thickness.

#### 2.3.7 Plastic

Plastic has built-in inhibitors to retard fading and anti-static compounds to retard dirt attraction. Pigment quality eliminates need to paint plastic parts. Component surfaces have a textured finish. Color is integral to the plastic.

#### 2.3.8 Cast Iron

Cast iron complies with **ASTM A48/A48M**. Finish is [powder coat] [\_\_\_\_\_] .

#### 2.3.9 Steel

Steel complies with **ASTM A513/A513M** or **ASTM A1011/A1011M**. Finish is [powder coat] [\_\_\_\_\_] .

### 2.4 SEATING SYSTEM

Construct components and assembly free from objectionable projections or irregularities. Make corners and edges smooth and rounded. Unless otherwise noted, bolts, nuts, and other fastenings are concealed where possible. Steel is well-formed to shape and size required. Connections of

members are by welding, riveting, or interlocking. Casting is fine textured, sound, and free of pits, blow holes, and fins. Lines are true, accurate, and true-to-pattern with excess metal or imperfections removed. Submit [Assembly Manuals](#), manufacturer's descriptive data, catalog cuts, installation instructions and the following:

- a. Minimum **6 by 6 inches** samples of upholstery, exposed plywood, plastic laminate, wood, identification plate, paint, armrest and plastic finish materials. Furnish fabric samples of sufficient size to show color range, pattern, and finish.
- b. Two complete sets of certificates attesting that the proposed seating system meets specified requirements. Date the certificate after the award of contract, include name of the project and a list of specific requirements being certified. Three sets of assembly manuals describing assembly procedures.
- c. One complete chair that meets requirements specified. Chair sample may be incorporated into the installation, provided the sample is approved and its location is noted.

#### 2.4.1 Backs

Provide back assembly of the fixed type and consisting of [a hard injection molded surface rear panel with an upholstered inner panel] [an exposed plywood front and rear panel]. Attach back assembly to standards with 14 gauge steel wings/back brackets; wings/back brackets have back pitch adjustability option, back assembly length is between [20] [\_\_\_\_\_] and [28-1/2] [\_\_\_\_\_] inches for a total height of [30] [\_\_\_\_\_] to [36] [\_\_\_\_\_] inches above the floor measured parallel to the back. Rear panel extends below the seat unit to completely conceal and protect the seat assembly.

##### 2.4.1.1 Plastic Rear Panels

Panels are one-piece injection molded high impact resistant polypropylene or polyethylene with textured outer surface. Panel is formed to enclose and protect the edges of the inner upholstery panel at the top and sides.

##### 2.4.1.2 [Plastic Laminate Finish] [Wood] Rear Panels

Panels are fabricated from minimum [5 ply, **5/16 inch**] [7 ply, **5/8 inch**] thick plywood. [Exposed back surface is plastic laminate.] Rear panel is formed on the same radius as the upholstered inner panel. Sand smooth exposed wood edges. [ Exposed bolts, fasteners or other hardware are not acceptable.]

##### 2.4.1.3 Upholstered Inner Panels

Fabricate upholstered inner panels from 5 ply, **7/16 inch** minimum thick plywood, compound steel or compound curved 20 percent glass filled polypropylene with deep web reinforcing. Cushion consists of [ **2 inch**] [\_\_\_\_\_] thick polyurethane foam padding and have an upholstery cover. Padding is cemented to plywood inner panel. Upholstery cover is securely stapled to the inner plywood panel or held in place with draw strings for ease of re-upholstering. Upholstery cover cannot be attached with the use of nails, tacks, or screws.

##### 2.4.1.4 Exposed Plywood Front & Rear Panel [Plastic Laminate Finish]

Back is fabricated from minimum [5-ply, 7/16 inch] [7-ply, 3/4 inch] thick contour molded plywood. [Exposed back and front surfaces are finished with plastic laminate.] Smoothly sand and finish all exposed edges.

#### 2.4.2 Seats

Provide foundation for upholstered seats free from visible screws, bolts, open holes, and projections on the bottom, front, and sides. [The front center edge of each seat has an identification plate. The area to receive the plate is recessed to prevent wear and abrasion. Method of attachment is tamper-resistant.] The seat unit is removable without disturbing the standards, and the upholstered seat cover is easily removable without removing the seat unit. The fabric covering is fastened to the frame in a manner that will permit easy reupholstering.

##### 2.4.2.1 Polypropylene Seat Unit

Provide foundation consisting of a one-piece, injection molded polypropylene foundation fabricated with a minimum 25 percent glass-filled polypropylene or an inner structural panel constructed of 20 percent glass-filled polypropylene with deep web reinforcing and a wraparound polypropylene shell outer panel. Polypropylene foundation seat is serpentine spring or ergonomic seat cushion. Serpentine spring cushion contains at least five serpentine design springs spanning an injection molded plastic frame with molded polyurethane foam padding fitting firmly on springs. Frame and spring assembly are covered with a chafing barrier to protect foam padding from abrasion. Ergonomic seat cushion consists of a 3/16 inch thick contoured polypropylene substrate supporting a polyurethane foam pad. Seat unit consisting of an inner structural panel has padding that is a molded polyurethane foam pad and has a minimum thickness of 3 inches at the center, 1-1/2 inches at the front with an overall thickness of 2 inches. Upholstery cover fits the cushion size, is fastened with drawstring closure or staples for ease of re-upholstering, and does not have welts. Upholstery cover cannot be attached with the use of nails, tacks, or screws.

#### 2.4.3 Hinges

Hinges are a counterweight mechanism using gravity to return to the upright position, compensating type or spring lift mechanism, completely enclosed in the seat assembly, totally independent, free and easy in operation, and capable of compensating for circular installation, variation in installation conditions, and unevenness of floors. Each hinge has a noiseless, self-rising seat device, rises automatically to a uniform safety position of 3/4 fold at all times, and folds 100 percent when additional pressure is applied, to provide additional clearance. Seat hinge mechanism complies with ASTM F851 and requires no adjustment after installation. The compensating type and spring lift mechanism hinge is self-lubricating requiring no maintenance. Cushion both the up and down stops on the seat to reduce noise.

#### 2.4.4 Standards

Provide standards which are minimum 14 gauge tubular or sheet steel or one integral piece of cast iron. Steel standards are welded. Standards with ADA hinged armrests are provided with a label displaying the handicapped symbol and located and installed as shown on drawings.



#### 2.4.4.1 Floor Standards

Form floor standards to fit the floor incline so that the standards will be vertical and the hinge point will be at a height that will maintain proper relation of seat to floor. Form the feet to eliminate tripping hazards, with a minimum of two holes for bolt attachment to the floor.

#### 2.4.4.2 Riser Standards

Form riser standards to approach the riser face at an angle to allow maximum clearance, formed to fit the riser so that the standards will be vertical and the hinge point will be at a height that will maintain proper relation of seat to floor. Projection of the standard is not permitted in order to avoid a stumbling hazard or interfere with sweeping and cleaning. Provide riser attachment through a 1/4 inch steel plate welded to the standard or on an integrally cast foundation. Provide securely attached standard to the riser without the use of shims or filler strips and attach at a minimum of 2 points.

#### 2.4.4.3 [Aisle] [and] [End] Standards

[Aisle] [and] [end] standard complies with standard specifications and have a [molded plastic] [plastic laminate] [upholstered] [solid hardwood or wood veneer] [\_\_\_\_\_] decorator panel. [Shape of decorator panel is [open] [tapered] [rectangular] [radius on lower edge] [\_\_\_\_\_] .] Decorator panels are not required for standards that have the ADA armrest. Install all decorator panels with concealed hardware.

#### 2.4.5 Armrests

Armrests are [solid hardwood with [rounded corners] [\_\_\_\_\_] and manufacturer's standard finish] [with cup holder] [wood with laminated plastic] [plastic] [plastic with cup holder] [\_\_\_\_\_]. Provide ADA armrest in locations as shown on drawings. ADA armrest is hinged at rear to allow easy access for limited mobility occupants.

#### 2.4.6 Tablet Arm

Equip each chair with a fold-away tablet arm assembly. Tablet arm will automatically return to the stored position when raised manually to a vertical position in one motion and fall to the stored position by force of gravity, fold smoothly and quietly, store completely out of the way and be easily accessible when needed by the occupant without bending or reaching. Tablet arm is fabricated using balanced construction and is composed of manufacturer's standard core material faced with plastic laminate on the writing surface and supported by a minimum 11 gauge steel bracket. All edges are rounded. When in a writing position, the arm locks firmly in place so that it cannot be accidentally disengaged. [Tablet arm [ is capable of supporting a laptop computer] [ and is a minimum of [ 83 square inches] [ 100 square inches] [ 120 square inches] [ 131 square inches] [ 151 square inches.]]] Provide both left and right handed tablet arms as show.

#### [2.4.7 Sub Title

Provide power [and data] to each seat in a location that is convenient to the occupant. Include a 120 Volt wiring with duplex receptacle [and a telecommunications and data port] per seat. Provide power [and data] from the building power source and insure that all power [and data] components are UL listed and conform to Article No. 604 of the National Electric Code.

Connect all chairs in a row with a formed aluminum raceway with [molded] [or] [extruded] polymer covers to conceal power [and data] wiring [in the arm rest] [on raceway beneath the seating] [in fully enclosed wireways]. Provide 120 Volt, A.C. electrical power throughout the row [by means of a [two circuit, 4 wire system to power up to 16 chairs] [three circuit, 5 wire system to power up to 24 chairs] [with a doubled sized neutral]]. [Use a separate molded polymer module to accommodate owner supplied ethernet, USB, phone and HDMI wiring.]

#### ]2.4.8 Identification Plates

Provide seating with number and letter plates for seat and row designations. Plates are constructed of manufacturer's standard [brass or bronze] [clear anodized aluminum] [\_\_\_\_\_] finish and have black letters and numbers. Provide [tamper resistant] hardware with finish compatible with plates. Provide text font and seat numbering system [per manufacturer's standard.] [as indicated.]

#### 2.4.9 Aisle Lighting

Provide [aisle] [and] [end] standard panels with [concealed] [surface mounted] [\_\_\_\_\_] LED aisle lights. Aisle lights are low voltage, 12 Volt, D.C., system with manufacture's voltage reduction device housed in safety enclosure equipped with fuses, terminal blocks, and safety disconnect. Aisle lighting is prewired, UL approved and wiring is routed through concealed casing into floor. Provide low heat generating lighting fixture components that are easily accessible for replacement. Aisle light wiring is hardwired to the building electric distribution system. The installation, proper safe mounting, and connection of the voltage reduction device, is the responsibility of a certified electrician.

#### [2.4.10 Electrical [and Telecommunications] Work

Provide electrical materials conforming to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM [and telecommunications materials conforming to the requirements of Section 27 10 00 BUILDING TELECOMMUNICATIONS SYSTEM]..

#### ]2.5 COLOR

Provide colors [as specified in Section 09 06 00 SCHEDULES FOR FINISHES.] [as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.]

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Examine floor, riser, and other adjacent work and conditions prior to layout and installation. Verify compliance with requirements and other conditions affecting performance of the work. [Verify that electrical connections are properly located.] [Verify HVAC air-distribution locations are correct.] Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PLACEMENT OF STANDARDS

The system permits the standards to be installed on radial lines from a

common center for which concentric circles are determined with each row of units utilizing common middle standards. Standards in each row are placed laterally so the aisle-end standards will be in alignment as indicated on seating layout drawing. The angle of inclination of backs adjusted for variations in sightlines. Mechanical attachment of components is of sufficient flexibility so that when permanently assembled they will compensate for the changing dimensions laterally between standards caused by convergence toward the center. Seat and back attachments absorb inaccuracies in lateral spacing of standards at point of attachment caused by unevenness of floor. Varying lateral dimensions of backs and seats are in accordance with approved seating layout. Minimum width of seating unit is 20 inches and may be used only to complete a specific row dimension.

### 3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Installation of the seating system is in accordance with the approved [detailed drawings](#) and manufacturer's recommended installation instructions. Submit seating plans dimensioned and showing row spacing, row lengths, the varying lateral spacing at backs and seats, back pitch, and seat widths for the various section lengths, placement of standards, floor pitch, and riser height, where applicable. Submit drawings indicating metal thickness, fastenings, details of hinge mechanism, seat and back dimensions, and proposed finish.

### 3.4 CLEANING

Clean and polish all products and leave the area in a clean and neat condition upon completion of installation. Repair any defects in material and installation and replace damaged products that cannot be satisfactorily repaired.

-- End of Section --

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## SECTION 13 34 19

## METAL BUILDING SYSTEMS

08/20, CHG 1: 02/21

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

- AA ADM (2020) Aluminum Design Manual
- AA ASD1 (2017; Errata 2017) Aluminum Standards and Data

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA/WDMA/CSA 101/I.S.2/A440 (2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 325 (2017) Steel Construction Manual
- AISC 341 (2016) Seismic Provisions for Structural Steel Buildings
- AISC 360 (2016) Specification for Structural Steel Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

- AISC/AISI 121 (2007) Standard Definitions for Use in the Design of Steel Structures
- AISI D100 (2017) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

- ASCE 7-16 (2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- ASHRAE 90.1 - IP (2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-6 2021; Addenda AS-BF 2022) Energy Standard for Buildings Except Low-Rise Residential

## Buildings

ASHRAE 90.1 - SI	(2019; Errata 1-4 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 5-7 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AU-BF 2020) Energy Standard for Buildings Except Low-Rise Residential Buildings
AMERICAN WELDING SOCIETY (AWS)	
AWS A5.1/A5.1M	(2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2018) Structural Welding Code - Sheet Steel
ASTM INTERNATIONAL (ASTM)	
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A463/A463M	(2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A475	(2022) Standard Specification for Metallic-Coated Steel Wire Strand
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A501/A501M	(2021) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A529/A529M	(2019) Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A606/A606M	(2018) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A755/A755M	(2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2021a) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A992/A992M	(2020) Standard Specification for Structural Steel Shapes
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B695	(2021) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C273/C273M	(2020) Standard Test Method for Shear Properties of Sandwich Core Materials
ASTM C518	(2021) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C665	(2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C991	(2016) Flexible Glass Fiber Insulation for Metal Buildings
ASTM C1289	(2022) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1363	(2019) Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
ASTM D522/D522M	(2017) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2017) Standard Test Method for



	Evaluating Degree of Blistering of Paints
ASTM D822	(2013; R 2018) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D1622/D1622M	(2014) Apparent Density of Rigid Cellular Plastics
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D5359	(2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
ASTM D6226	(2015) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM DEFONLINE	(2008) ASTM Online Dictionary of Engineering Science and Technology
ASTM E84	(2020) Standard Test Method for Surface

	Burning Characteristics of Building Materials
ASTM E96/E96M	(2022) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E1646	(1995; R 2018) Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Air Pressure Difference
ASTM E1680	(2016) Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
ASTM F436/F436M	(2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F844	(2019) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1852	(2014) Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies,

Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

ASTM G152 (2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

ASTM G153 (2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM (2018) Metal Building Systems Manual

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 (2006) Metal Finishes Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2022) Standard for Fire Doors and Other Opening Protectives

NFPA 252 (2022) Standard Methods of Fire Tests of Door Assemblies

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA RoofMan (2020) The NRCA Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793 (2012) Architectural Sheet Metal Manual, 7th Edition

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 15 (1999; E 2004) Steel Joist Shop Primer/Metal Building Primer

SSPC Painting Manual (2002) Good Painting Practice, Steel Structures Painting Manual, Volume 1

SSPC SP 2 (2018) Hand Tool Cleaning

STEEL WINDOW INSTITUTE (SWI)

SWI AGSW (2002) Architect's Guide to Steel Windows

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health

## Requirements Manual

## U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2019, with Change 1, 2022) Structural Engineering
UFC 3-301-02	(2020) Design of Risk Category V Structures, National Strategic Military Assets
UFC 4-010-01	(2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

## UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(updated continuously online) Building Materials Directory
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## 1.2 GENERAL REQUIREMENTS

## 1.2.1 Design Parameters

Design and construct pre-engineered metal buildings of size, shape, height, fenestration, siting, and configuration indicated. Coordinate site utility services, accessibility requirements, vehicular and pedestrian access, mechanical, electrical, plumbing and fire protection requirements, interior construction and finishes, and such other items as may be necessary for a complete, functional building.

## 1.2.2 Structural Performance

Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within the limits and conditions indicated.

## 1.2.2.1 Engineering

Design metal building systems conforming to procedures described in [MBMA MBSM](#).

## 1.2.2.2 Design Loads

Design and construct to the requirements of [UFC 3-301-01](#), Structural Engineering.

## [1.2.3 Anti-terrorism Requirements

Design metal building systems to comply with the requirements of [UFC 4-010-01](#).

## ]1.2.4 Thermal Performance

Provide insulated metal panel assemblies with the following maximum U-factors when assemblies are tested or calculated according to [ASHRAE 90.1 - SI](#) [ASHRAE 90.1 - IP](#) Appendix A, and minimum R-values for opaque elements when tested according to [ASTM C1363](#) or [ASTM C518](#).

## 1.2.4.1 Metal Roof Panel Assemblies

a. U-Factor: [\_\_\_\_\_]

b. R-Value: [\_\_\_\_\_]

#### 1.2.4.2 Metal Wall Panel Assemblies

a. U-Factor: [\_\_\_\_\_]

b. R-Value: [\_\_\_\_\_]

#### 1.2.5 Air Infiltration for Metal Roof Panels

Air leakage through assembly must not exceed [0.04 cfm/sq.ft.] [\_\_\_\_\_] of roof area when lab tested according to [ASTM E1680](#) at negative test-pressure difference of [1.57 lbf/sq.ft.] [\_\_\_\_\_].

#### 1.2.6 Air Infiltration for Metal Wall Panels

Air leakage through assembly of not more than [0.04 cfm/sq.ft.] [\_\_\_\_\_] of wall area when labtested according to [ASTM E283](#) at static-air-pressure difference of [1.57 lbf/sq.ft.] [\_\_\_\_\_].

#### 1.2.7 Water Penetration for Metal Roof Panels

No water penetration when tested according to [ASTM E1646](#) at test-pressure difference of [2.86 lbf/sq.ft.] [\_\_\_\_\_].

#### 1.2.8 Water Penetration for Metal Wall Panels

No water penetration when tested according to [ASTM E331](#) at a minimum differential pressure of [20] [\_\_\_\_\_] percent of inward-acting, wind-load design pressure of not less than [6.24 lbf/sq.ft.] [\_\_\_\_\_] and not more than 12 lbf/sq. ft.

#### 1.2.9 Specular Gloss

Finished roof surfaces to have a specular gloss value of [30 plus or minus 5 at an angle of 60 degrees] [10 or less at an angle of 85 degrees] when measured in accordance with [ASTM D523](#).

#### 1.2.10 Wind-Uplift Resistance

Design for wind-uplift resistance in accordance with [UFC 3-301-01](#).

#### 1.2.11 Erection Plan

Provide plans and a written erection/lifting procedure with required plans clearly showing the intended sequence and method of erection in accordance with [EM 385-1-1](#) "Safety - Safety and Health Requirements". Indicate required crane lifting requirements, temporary support structures, member size and locations of braced or guyed temporary supports, and locations of bracing or guys anchor points. Clearly define the required framing sequence and conditions necessary to ensure the structure is maintained in a properly braced and stable condition throughout the complete erection process.

### 1.3 DEFINITIONS

a. Bay: Dimension between main frames measured normal to frame (at

centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.

- b. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).
- c. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
- d. Terminology Standard: Refer to MBMA "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

#### 1.4 SYSTEM DESCRIPTION

General: Provide a complete, integrated set of [ metal building system manufacturer's standard] mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, [ metal roof panels,] [ metal wall panels,] and accessories complying with requirements indicated.

Provide metal building system of size and with spacing, slopes, and spans indicated.

##### 1.4.1 Primary Frame Type

- [ a. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- ] [b. Rigid Modular: Solid-member, structural-framing system with interior columns.
- ] [c. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
- ] [d. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
- ] [e. Long Bay: Solid- or truss-member, structural-framing system without interior columns.
- ] [f. Lean To: Solid- or truss-member, structural-framing system without interior columns, designed to be partially supported by another structure.

##### ] [1.4.2 Fixed End-Wall Framing

Provide manufacturer's standard fixed end wall, for buildings not required to be expandable, consisting of [ primary frame, capable of supporting one-half of a bay design load, and end-wall columns] [ load-bearing end-wall with corner columns, and rafters].

##### ] [1.4.3 Expandable End-Wall Framing

Provide engineered end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

#### ]1.4.4 Secondary Frame Type

Provide manufacturer's standard purlins and joists and [flush-framed] [partially inset-framed] [exterior-framed (bypass)] girts.

#### 1.4.5 Eave Height

Eave height must be [16 feet] [20 feet] [24 feet] [28 feet] [\_\_\_\_\_] [Manufacturer's standard height, as indicated by nominal height on Drawings].

#### 1.4.6 Bay Spacing

Bay Spacing must be [20 feet] [25 feet] [30 feet] [\_\_\_\_\_] [As determined by manufacturer].

#### 1.4.7 Roof Slope

Roof slope must be [1/2 inch per 12 inches] [1 inch per 12 inches] [4 inches per 12 inches] [\_\_\_\_\_] [manufacturer's standard for frame type required].

#### 1.4.8 Roof System

Provide manufacturer's standard [vertical-rib, standing-seam] [trapezoidal-rib standing-seam] [lap-seam] metal roof panels [with insulation].

#### 1.4.9 Exterior Wall System

Provide [field-assembled, insulated] [field-assembled, un-insulated] [factory-assembled, insulated] metal wall panels [complete with vapor barrier conforming to ASTM E96/E96M] [or, where required, an exterior wall system complying with UFC 4-010-01 and these specifications for the project location and site characteristics].

### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.] [for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Manufacturer's Qualifications; G[, [\_\_\_\_\_] ]

#### SD-02 Shop Drawings

Detail Drawings; G[, [\_\_\_\_\_] ]

Erection Plan; G[, [\_\_\_\_\_] ]

#### SD-03 Product Data

Manufacturer's Catalog Data; G[, [\_\_\_\_\_]]

Recycled Content for Structural Steel Shapes and Plates; S

Recycled Content for Steel Pipe; S

Recycled Content for Aluminum Sheet Materials; S

Recycled Content for Steel Sheet Materials; S

Recycled Content for Insulation Materials; S

#### SD-04 Samples

Coil Stock, 12 inches long by the actual panel width; G[, [\_\_\_\_\_]]

Roof Panels, 12 inches long by actual panel width; G[, [\_\_\_\_\_]]

Wall Panels, 12 inches long by actual panel width; G[, [\_\_\_\_\_]]

Fasteners; G[, [\_\_\_\_\_]]

Metal Closure Strips 10 inches long of each type; G[, [\_\_\_\_\_]]

Insulation, approximately 8 by 11 inches; G[, [\_\_\_\_\_]]

Vapor Barrier; G[, [\_\_\_\_\_]]

Manufacturer's Color Charts and Chips, 4 by 4 inches; G[, [\_\_\_\_\_]]

#### SD-05 Design Data

Manufacturer's Descriptive and Technical Literature; G[, [\_\_\_\_\_]]

Manufacturer's Building Design Analysis; G[, [\_\_\_\_\_]]

Lateral Force Calculations; G[, [\_\_\_\_\_]]

#### SD-06 Test Reports

Test Reports; G[, [\_\_\_\_\_]]

Coatings and Base Metals; G[, [\_\_\_\_\_]]

Factory Color Finish Performance Requirements; G[, [\_\_\_\_\_]]

#### SD-07 Certificates

System Components; G[, [\_\_\_\_\_]]

Coil Stock Certificates; G[, [\_\_\_\_\_]]

Aluminized Steel Repair Paint; G[, [\_\_\_\_\_]]

Galvanizing Repair Paint; G[, [\_\_\_\_\_]]

Enamel Repair Paint; G[, [\_\_\_\_\_]]



Qualification of Manufacturer; G[, [\_\_\_\_]]

Qualification of Erector; G[, [\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Installation of Roof and Wall panels; G[, [\_\_\_\_]]

Shipping, Handling, and Storage; G[, [\_\_\_\_]]

#### SD-11 Closeout Submittals

Manufacturer's Warranty; G[, [\_\_\_\_]]

Contractor's Warranty for Installation; G[, [\_\_\_\_]]

### 1.6 QUALITY ASSURANCE

#### 1.6.1 Pre-Erection Conference

After submittals are received and approved but before metal building system work, including associated work, is performed, the Contracting Officer will hold a pre-erection conference to review the following:

- a. The [detail drawings](#), specifications, and [manufacturer's descriptive and technical literature](#).
- b. Finalize construction schedule and verify availability of materials, erector's personnel, equipment, and facilities needed to make progress and avoid delays.
- c. Methods and procedures related to metal building system erection, including, but not limited to: [qualification of manufacturer](#), [qualification of erector](#), [manufacturer's catalog data](#), [manufacturer's building design analysis](#), [lateral force calculations](#), written instructions and [test reports](#). Lateral force calculations must include all analysis and confirmation of system components required to transfer lateral forces to the foundation.
- d. Support conditions for compliance with requirements, including alignment between and erection of structural members.
- e. Flashing, special roofing and siding details, roof and wall penetrations, openings, and condition of other construction that will affect the metal building system, including [coatings and base metals](#), [factory color finish performance requirements](#), [system components](#), and [coil stock certificates](#).
- f. Governing regulations and requirements for, certificates, insurance, tests and inspections if applicable.
- g. Temporary protection requirements for metal panel assembly during and after installation.
- h. Samples of [roof panels](#), [wall panels](#), [aluminized steel repair paint](#), [galvanizing repair paint](#), and [enamel repair paint](#).

##### 1.6.1.1 Pre-Roofing and Siding Installation Conference

After structural framing system erection and approval but before roofing, siding[, insulation and vapor barrier] work, including associated work, is performed; the Contracting Officer will hold a pre-roofing and siding conference to review the following:

- a. Examine purlins, sub-girts and formed shapes conditions for compliance with requirements, including flatness and attachment to structural members.
- b. Review structural limitations of purlins, sub-girts and formed shapes during construction and after roofing and siding.
- c. Review flashings, special roof and wall details, roof drainage, roof and wall penetrations, roof equipment curbs, and condition of other construction that will affect the metal building system.
- d. Review temporary protection requirements for metal roof and wall panels' assembly during and after installation.
- e. Review roof and wall observation and repair procedures after metal building system erection.

#### 1.6.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products, erection of structural framing and [installation of roof and wall panels](#) in the geographical area where construction will take place.

#### 1.6.3 [Manufacturer's Qualifications](#)

Metal building system manufacturer must have a minimum of five years experience as a qualified manufacturer and a member of MBMA of metal building systems and accessory products.

Provide engineering services by an authorized currently licensed engineer in the geographical area where construction will take place, having a minimum of four years experience as an engineer knowledgeable in building design analysis, protocols and procedures for the "Metal Building Systems Manual" ([MBMA MBSM](#)); [ASCE 7-16](#), [the building code in the geographic area where the construction will take place] and [ASTM E1592](#). Provide certified engineering calculations using the products submitted for:

- a. Roof and Wall Wind Loads with basic wind speed, exposure category, co-efficient, importance factor, designate type of facility, negative pressures for each zone, methods and requirements of attachment.
- b. Roof Dead and Live Loads
- c. Collateral Loads
- d. Foundation Loads
- e. Roof Snow Load
- f. Seismic Loads

#### 1.6.4 Qualification of Erection Contractor

An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and must be approved and certified by the metal building system manufacturer.

#### 1.6.5 Single Source

Obtain primary and secondary components and structural framing members, each type of metal roof, wall and liner panel assemblies, clips, closures and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

#### 1.6.6 Welding

Qualify procedures and personnel according to [AWS A5.1/A5.1M](#), [AWS D1.1/D1.1M](#), and [AWS D1.3/D1.3M](#).

#### 1.6.7 Structural Steel

Comply with [AISC 325](#), [[AISC 341](#) for seismic impacted designs,] [AISC 360](#), for design requirements and allowable stresses.

#### 1.6.8 Cold-Formed Steel

Comply with [AISC/AISI 121](#) and [AISI D100](#) for design requirements and allowable stresses.

#### 1.6.9 Fire-Resistance Ratings

Where indicated, provide metal panels identical to those of assemblies tested for fire resistance in accordance with [ASTM E119](#), as certified by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from [UL Bld Mat Dir](#) or from the listings of another qualified testing agency. Combustion Characteristics must conform to [ASTM E136](#).

#### 1.6.10 Surface-Burning Characteristics

Provide metal panels having[ field-insulation][ insulation core][ insulation and [vapor barrier](#)] material with the following surface-burning characteristics as determined by testing identical products according to [ASTM E84](#) by a qualified testing agency. Identify products with appropriate markings of applicable testing agency showing:

- a. Flame-Spread Index: [25] [\_\_\_\_\_] or less.
- b. Smoke-Developed Index: [450] [\_\_\_\_\_] or less.

#### 1.6.11 Fabrication

Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles with dimensional and structural requirements. Provide metal panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Aluminum and aluminum-alloy sheet and plate must conform to [ASTM B209](#). Fabricate

metal panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in [SMACNA 1793](#) that apply to the design, dimensions, metal, and other characteristics of item indicated:

- a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- c. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA or by metal building system manufacturer for application, but not less than thickness of metal being secured.

#### 1.6.12 Finishes

Comply with [NAAMM AMP 500](#) for recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### 1.7 SHIPPING, HANDLING AND STORAGE

#### 1.7.1 Delivery

Package and deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed and protected during transportation and handling.

#### 1.7.2 Storage

Stack and store metal panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Store in a manner to prevent bending, warping, twisting, and surface damage. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage. Retain strippable protective covering on metal panel for entire period up to metal panel installation.

#### 1.7.3 Protection of Materials

Protect foam-plastic insulation as follows:

- a. Do not expose to sunlight, except to extent necessary for period of

installation and concealment.

- b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to project site before installation time.

Complete installation and concealment of plastic materials as rapidly as possible in each area of construction to minimize ultraviolet exposure.

## 1.8 PROJECT CONDITIONS

### 1.8.1 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing panel system or building.

### 1.8.2 Field Measurements

#### 1.8.2.1 Established Dimensions for Foundations

Comply with established dimensions on approved anchor-bolt plans, established foundation dimensions, and proceed with fabricating structural framing. Do not proceed without verifying field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

#### 1.8.2.2 Established Dimensions for Metal Panels

Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

#### 1.8.2.3 Verification Record

Verify locations of all framing and opening dimensions by field measurements before metal panel fabrication and indicate measurements on Shop Drawings.

## 1.9 COORDINATION

Coordinate final design and placement of foundation between structural engineer of record, geotechnical engineer, MBMA and Contractor. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in section on CAST-IN-PLACE CONCRETE.

Coordinate installation of [fire suppression system] [equipment supports] [piping and supports] [ and ] [accessories], which are specified in Division 21 - FIRE SUPPRESSION.

Coordinate installation of [plumbing system] [equipment supports] [piping and supports] [and] [accessories], which are specified in Division 22 - PLUMBING.

Coordinate installation of [HVAC system] [equipment supports] [ductwork and supports] [piping and supports] [ and ] [accessories], which are specified in

Division 23 - HEATING, VENTILATING AND AIR-CONDITIONING (HVAC).

Coordinate installation of [roof curbs] [equipment supports][ and ][roof penetrations], which are specified in Division 07 - THERMAL AND MOISTURE PROTECTION.

Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leak-proof, secure, and non-corrosive installation.

#### 1.10 WARRANTY

##### 1.10.1 Building System Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal building system. The warranty period is to be no less than [5] [10] [15] [20] years from the date of acceptance of the work and be issued directly to the Government. The warranty must provide that if within the warranty period, the metal building system shows evidence of deterioration resulting from defective materials or workmanship, correcting of any defects is the responsibility of the metal building system manufacturer. Repairs that become necessary because of defective materials and workmanship while metal building system is under warranty are to be performed within [32] [\_\_\_\_\_] hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within [32] [\_\_\_\_\_] hours of notification will constitute grounds for having emergency repairs performed by others and will not void the warranty.

##### 1.10.2 Roof System Weather-Tightness Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than [10] [20] [\_\_\_\_\_] years from the date of acceptance of the work and be issued directly to the Government.

The warranty is to provide that if within the warranty period the roof panel system shows evidence of corrosion, perforation, rupture, lost of weather-tightness or excess weathering due to deterioration of the panel system resulting from defective materials and correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Repairs that become necessary because of defective materials and workmanship while roof panel system is under warranty are to be performed within [24] [\_\_\_\_\_] hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform [temporary] repairs within [24] [\_\_\_\_\_] hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty. Immediate follow-up and completion of permanent repairs must be performed within [\_\_\_\_\_] days from date of notification.

##### 1.10.3 Roof and Wall Panel Finish Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than [10] [20] [\_\_\_\_\_] years from the date of acceptance of the work and be issued directly to the Government.

The warranty is to provide that if within the warranty period the metal

panel system shows evidence of checking, delaminating cracking, peeling, chalk in excess of a numerical rating of eight, as determined by [ASTM D4214](#) test procedures; or change colors in excess of five CIE or Hunter units in accordance with [ASTM D2244](#) or excess weathering due to deterioration of the panel system resulting from defective materials and finish or correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Liability under this warranty is exclusively limited to replacing the defective coated materials.

Repairs that become necessary because of defective materials and workmanship while roof and wall panel system is under warranty are to be performed within [32] [\_\_\_\_\_] hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within [32] [\_\_\_\_\_] hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty.

## PART 2 PRODUCTS

### 2.1 STRUCTURAL FRAMING MATERIALS

#### 2.1.1 Steel Shapes and Plates

Wide flange and WT shapes: [ASTM A992/A992M](#); [ASTM A572/A572M](#) or [ASTM A529/A529M](#). Angles, Channels and Plates: [ASTM A36/A36M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#). Provide structural steel shapes and plates containing a minimum of [80] [\_\_\_\_\_] percent recycled content. Submit data identifying percentage of [recycled content for structural steel shapes and plates](#).

#### 2.1.2 Steel Pipe

[ASTM A36/A36M](#), [ASTM A53/A53M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#). Provide steel pipe containing a minimum of [50] [\_\_\_\_\_] percent recycled content. Submit data identifying percentage of [recycled content for steel pipe](#).

#### 2.1.3 Cold-Formed and Hot Formed Hollow Structural Sections

Cold formed: [ASTM A500/A500M](#) or [ASTM B221](#), [ASTM B221M](#). Hot-formed: [ASTM A501/A501M](#).

#### 2.1.4 Structural-Steel Sheet

Hot-rolled, [ASTM A1011/A1011M](#) or cold-rolled, [ASTM A1008/A1008M](#).

#### 2.1.5 Metallic-Coated Steel Sheet

[ASTM A653/A653M](#), [ASTM A606/A606M](#).

#### 2.1.6 Metallic-Coated Steel Sheet Pre-painted with [Coil Stock](#) Coating

Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with [ASTM A755/A755M](#).

[ a. Zinc-Coated (Galvanized) Steel Sheet: [ASTM A653/A653M](#), and [ASTM A123/A123M](#).

] [b. Aluminum-Zinc Alloy-Coated Steel Sheet: [ASTM A792/A792M](#), and

ASTM A463/A463M.

]2.1.7 Joist Girders

Refer to Section 05 21 00 STEEL JOIST FRAMING

2.1.8 Steel Joists

Refer to the following sections subject to project design requirements:

Section 05 21 00 STEEL JOIST FRAMING

2.1.9 High-Strength Bolts, Nuts, and Washers

ASTM F3125/F3125M, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436/F436M hardened carbon-steel washers.

Finish: [Plain] [Hot-dip zinc coating, ASTM A153/A153M] [Mechanically deposited zinc coating, ASTM B695].

Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, heavy-hex-head steel structural bolts with spline.

Finish: [Plain] [Mechanically deposited zinc coating, ASTM B695] [Mechanically deposited zinc coating, ASTM B695 baked epoxy coated].

2.1.10 Non-High-Strength Bolts, Nuts, and Washers

ASTM A307, ASTM A563, and ASTM F844.

Finish: [Plain] [ASTM A153/A153M] [ASTM B695].

2.1.11 Anchor Rods

[ASTM F1554] [ASTM A572/A572M] [ASTM A36/A36M] [ASTM A307].

- a. Configuration: Straight.
- b. Nuts: ASTM A563 [heavy] hex carbon steel.
- c. Plate Washers: ASTM A36/A36M carbon steel.
- d. Washers: ASTM F436/F436M hardened carbon steel.
- e. Finish: [Plain] [Hot-dip zinc coating, ASTM A153/A153M] [Mechanically deposited zinc coating, ASTM B695].

2.1.12 Threaded Rods

[ASTM A193/A193M] [ASTM A572/A572M] [ASTM A36/A36M] [ASTM A307].

- a. Nuts: ASTM A563MASTM A563 [heavy] hex carbon steel.
- b. Washers: [ASTM F436/F436M hardened] [ASTM A36/A36M] carbon steel.
- c. Finish: [Plain] [Hot-dip zinc coating, ASTM A153/A153M] [Mechanically deposited zinc coating, ASTM B695].

2.1.13 Primer



SSPC-Paint 15, Type I, red oxide.

## 2.2 FABRICATION

### 2.2.1 General

Comply with **MBMA MBSM** - "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

## 2.3 STRUCTURAL FRAMING

### 2.3.1 General

Clean all framing members to remove loose rust and mill scale. Provide 1 shop coat of primer to an average dry film thickness of 1 mil according to **SSPC SP 2**. Balance of painting and coating procedures must conform to **SSPC Paint 15** and **SSPC Painting Manual**.

### 2.3.2 Primary Framing

Manufacturer's standard structural primary framing system includes transverse and lean-to frames; rafter, rakes, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing designed to withstand required loads and specified requirements. Provide frames with attachment plates, bearing plates, and splice members. Provide frame span and spacing indicated.

Shop fabricate framing components by welding or by using high-strength bolts to the indicated size and section with base-plates, bearing plates, stiffeners, and other items required. Cut, form, punch, drill, and weld framing for bolted field erection.

- [ a. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
- ] [b. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from [steel round pipe] [steel tube] [shop-welded, built-up steel plates.]
- ] c. Frame Configuration: [Single gable] [One-directional sloped] [Lean to, with high side connected to, and supported by, another structure] [Multiple gables] [Load-bearing-wall type] [Multistory].
- d. Exterior Column Type: [Uniform depth] [Tapered].
- e. Rafter Type: [Uniform depth] [Tapered].

### 2.3.3 Secondary Framing

Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jamps, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre-painted with coil coating, unless otherwise indicated.

Shop fabricate framing components by roll-forming or break-forming to the indicated size and section with base-plates, bearing plates, stiffeners, and other plates required for erection. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

- a. Purlins: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; minimum depth [as indicated] [as required to comply with system performance requirements] [\_\_\_\_\_].
- b. Girts: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange minimum depth [as indicated] [as required to comply with system performance requirements] [\_\_\_\_\_].
- c. Eave Struts: Unequal-flange, C-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
- d. Flange Bracing: Structural-steel angles or cold-formed structural tubing to stiffen primary frame flanges.
- e. Sag Bracing: Structural-steel angles.
- f. Base or Sill Angles: Zinc-coated (galvanized) steel sheet.
- g. Purlin and Girt Clips: Steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
- h. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from [zinc-coated (galvanized) steel sheet] [structural-steel sheet].
- i. Framing for Openings: Channel shapes; fabricated cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
- j. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

#### 2.3.4 Bracing

Provide adjustable wind bracing as follows:

- a. Rods: **ASTM A36/A36M**; **ASTM A572/A572M**; or **ASTM A529/A529M** [threaded full length] [threaded a minimum of [\_\_\_\_\_]] at each end.
- b. Cable: **ASTM A475**, [\_\_\_\_\_] diameter, extra-high-strength grade, zinc-coated, [\_\_\_\_\_]-strand steel; with threaded end anchors.
- c. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
- d. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

- e. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- f. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- g. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

## 2.4 PANEL MATERIALS

### 2.4.1 Aluminum Sheet

Roll-form aluminum [roof] [wall] [liner] panels to the specified profile, with  $f_y = [.032] [.040] [.050]$  inch thickness and depth as indicated. Aluminum sheets must contain a minimum recycled content of 20 percent. Provide data identifying percentage of [recycled content for aluminum sheet materials](#). Material must be plumb and true, and within the tolerances listed:

- a. Aluminum Sheet conforming to [ASTM B209](#), [AA ADM](#) and [AA ASD1](#).
- b. Individual panels to have continuous length to cover the entire length of any [roof slope] [wall area] with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified.
  - 1. Profile and coverage to be a minimum height and width from manufacturer's standard for the indicated [roof slope] [wall area].
  - [ 2. Profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.
  - ] [ 3. Profile to be a 1-1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
  - ] [ 4. Profile to be a 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.
  - ] [ 5. Profile to be a 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.
  - ] [ 6. Profile to be a 1-3/4 inch high V-beam rib at 5 inches o.c., 44-7/8 inch overall width with 42 inch coverage and exposed fasteners.
  - ] [ 7. Profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.
  - ] [ 8. Profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 9. Profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ 10. [Smooth, flat] [Embossed] Surface Texture.

] [ 11. Custom profile to be [\_\_\_\_\_] [as shown on drawings].

#### ] 2.4.2 Steel Sheet

Roll-form steel [roof] [wall] [liner] panels to the specified profile, with fy = [26] [24] [22] [20] [18] gauge and depth as indicated. Steel sheets must contain a minimum recycled content of 25 percent. Provide data identifying percentage of [recycled content for steel sheet materials](#). Material must be plumb and true, and within the tolerances listed:

[ a. Galvanized Steel Sheet conforming to [ASTM A653/A653M](#) and [AISI D100](#).

] [b. Aluminum-Zinc Alloy-coated Steel Sheet conforming to [ASTM A792/A792M](#) and [AISI D100](#).

] c. Individual panels to have continuous length to cover the entire length of any unbroken [roof slope] [wall area] with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.

d. Provide panels with thermal expansion and contraction consistent with the type of system specified;

[ profile and coverage to be a minimum height and width from manufacturer's standard for the indicated [roof slope] [wall area].

] [ profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.

] [ profile to be a 1-1/2 inch high rib at 7.2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.

] [ profile to be a 1 inch high rib at 4 inches o.c., 49-5/8 inch overall width with [48] [44] inch coverage and exposed fasteners.

] [ profile to be a 1 inch high rib at 8 inches o.c., 41-5/8 inch overall width with 40 inch coverage and exposed fasteners.

] [ profile to be a 7/8 inch high corrugated rib at 2 inches o.c., 38-7/8 inch overall width with 36 inch coverage and exposed fasteners.

] [ profile to be a 3 inch high standing seam, 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ profile to be a [1] [1-3/4] [2] [2-1/2] inch high standing seam, [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.

] [ [Smooth, flat] [Embossed] Surface Texture.

] [ profile to be custom as shown on drawings.

#### ] 2.4.3 Foam-Insulation Core Wall Panel

Provide factory-formed [aluminum] [steel] [roof] [wall] panel assembly fabricated from two sheets of metal with modified polyisocyanurate or polyurethane foam insulation core [foamed-in-place] [board] during fabrication with joints between panels designed to form weather-tight seals. Include accessories required for weather-tight installation.

- a. Closed-Cell Content: 90 percent when tested according to ASTM D6226, ASTM C1289.
- b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622/D1622M.
- c. Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.
- d. Shear Strength: 26 psi when tested according to ASTM C273/C273M.

#### 2.4.4 Insulated Panel Construction

Shop fabricate or field assemble insulated panel construction with specified exterior and interior [aluminum] [steel] sheet in accordance with manufacturer's printed instructions.

Insulation to be [glass-fiber-ASTM C991] [slag-wool-fiber] [rock-wool-fiber] conforming to ASTM C553 and ASTM C612 of thickness and density as required for the geographical area where construction will take place.

Insulation fasteners to be adhesively attached, plate welded to projecting spindle anchors; capable of holding insulation of thickness indicated, secured in position with self-locking washer and complying with the following requirements:

- a. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
- b. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- c. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
- d. Anchor adhesive to be a product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

#### 2.4.5 Finish

All panels are to receive a factory-applied polyvinylidene fluoride of Kynar 500/Hylar 5000 finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.
- b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. This prime coat must be oven cured prior to application of finish coat.
- c. Exterior Finish Coating: Apply the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 0.05 mils for a total dry film thickness of 1.00 plus 0.10 mils. This finish coat must be oven-cured.
- d. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. The wash-coat must be oven-cured.
- e. Color: The exterior finish chosen from the [manufacturer's color charts and chips](#).
- f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

Chalking: [ASTM DEFONLINE](#)  
 Color Change and Conformity: [ASTM D2244](#)  
 Weatherometer: [ASTM G152](#), [ASTM G153](#) and [ASTM D822](#)  
 Humidity: [ASTM D2247](#) and [ASTM D714](#)  
 Salt Spray: [ASTM B117](#)  
 Chemical Pollution: [ASTM D1308](#)  
 Gloss at 60 degrees: [ASTM D523](#)  
 Pencil Hardness: [ASTM D3363](#)  
 Reverse Impact: [ASTM D2794](#)  
 Flexibility: [ASTM D522/D522M](#)  
 Abrasion: [ASTM D968](#)  
 Flame Spread: [ASTM E84](#)

#### 2.4.6 Repair Of Finish Protection

Repair paint for enameled metal panel must be compatible paint of the same formula and color as the specified finish furnished by the metal panel manufacturer, conforming to [ASTM A780/A780M](#).

### 2.5 MISCELLANEOUS METAL FRAMING

#### 2.5.1 General

Cold-formed metallic-coated steel sheet conforming to [ASTM A653/A653M](#) and specified in Section [05 40 00 COLD-FORMED METAL FRAMING](#) unless otherwise indicated.

#### 2.5.2 [Fasteners](#) for Miscellaneous Metal Framing

Refer to the following paragraph FASTENERS.

## 2.6 FASTENERS

### 2.6.1 General

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 1 inch with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the metal panel manufacturer's and ASCE 7-16 requirements.

### 2.6.2 Exposed Fasteners

Fasteners for metal panels to be corrosion resistant coated steel, aluminum, stainless steel, or nylon capped steel compatible with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories to be the manufacturer's standard. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick.

### 2.6.3 Screws

Screws to be corrosion resistant coated steel, aluminum or stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

### 2.6.4 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

### 2.6.5 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A653/A653M or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

## 2.7 FRAMES AND MATERIALS FOR OPENINGS

### 2.7.1 Doors

Fire-Rated and Non-Fire-Rated Door Assemblies conforming with NFPA 80 and based on testing according to NFPA 252 as specified in Division 08 - OPENINGS unless otherwise indicated.

### 2.7.2 Windows

[Aluminum ] [Steel ] Window Assemblies conforming to [ AAMA/WDMA/CSA 101/I.S.2/A440 ] [SWI AGSW] as specified in Division 08 - OPENINGS unless otherwise indicated.

## 2.8 ACCESSORIES

### 2.8.1 General

All accessories to be compatible with the metal panels; sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the metal panels. Exposed metal accessories/finishes to match the panels, except as

otherwise indicated. Molded foam rib, ridge and other closure strips to be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

#### 2.8.2 Roof and Wall Accessories and Specialties

[Aluminum ] [Galvanized Steel ] roof curbs, equipment supports, roof hatches, dropout-type heat and smoke vents, hatch-type heat and smoke vents, gravity and roof ridge ventilators, wall louvers and other miscellaneous roof and wall equipment or penetrations conforming to AAMA, ASTM, and UL as specified in Division 07 unless otherwise indicated.

#### 2.8.3 Insulation

Faced, Glass-Fiber Blanket Insulation: [ASTM C665](#), Type [I, blankets without membrane coverings] [ and ] [II, blankets with non-reflecting coverings] [ and ] [III, blankets with reflective coverings]; Class [A, membrane-faced surface with a flame spread of 25 or less] [B, membrane-faced surface with a flame propagation resistance; critical radiant flux of [0.11 Btu/ft<sup>2</sup>](#) or greater], except a flame spread rating of [25] [75] [100] or less [and a smoke developed rating of 150 or less] when tested in accordance with [ASTM E84](#). Provide insulation materials containing the following minimum percentage of recycled content by weight: 20 percent glass cullet complying with [ASTM D5359](#). Provide data identifying percentage of [recycled content for insulation materials](#).

##### 2.8.3.1 Polyethylene Vapor Retarder

Install polyethylene vapor retarder membrane over entire [wall] [ and roof] surface. Use fully compatible polyethylene tape to seal the edges of the sheets to provide a vapor tight membrane. Lap sheets not less than [6 inch](#). Provide sufficient material to avoid inducing stresses in sheets due to stretching or binding. All tears or punctures visible in the finished surface, at any time during the construction process, must be sealed with polyethylene tape.

##### 2.8.3.2 Wall Liner

Securely fasten wall liner into place in accordance with the manufacturer's recommendation and in a neatly presented appearance.

#### 2.8.4 Rubber Closure Strips

Closed-cell, expanded cellular rubber conforming to [ASTM D1056](#) and [ASTM D1667](#); extruded or molded to the configuration of the specified metal panel and in lengths supplied by the metal panel manufacturer.

#### 2.8.5 Metal Closure Strips

Factory fabricated closure strips to be the same material, thickness, color, finish and profile of the specified [roof] [wall] panel.

#### 2.8.6 2.6.6 Joint Sealants

##### 2.8.6.1 Sealants

Sealants are to be an approved gun type for use in hand or air-pressure caulking guns at temperatures above [40 degrees F](#) (or frost-free application at temperatures above [10 degrees F](#) with minimum solid content of 85 percent



of the total volume. Sealant is to dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the metal panel manufacturer.

#### 2.8.6.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to [ASTM C920](#), Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

#### 2.8.6.3 Field-Applied

[See Section [07 92 00 JOINT SEALANTS](#) for sealant requirements.] [Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to [ASTM C920](#), Type II. Color to match panel colors.]

#### 2.8.6.4 Tape Sealant

Pressure sensitive, 100 percent solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the metal panel manufacturer.

### 2.9 SHEET METAL FLASHING AND TRIM

#### 2.9.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in [SMACNA 1793](#) that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

### 2.10 FINISHES

#### 2.10.1 General

Comply with [NAAMM AMP 500](#) for recommendations for applying and designating finishes.

#### 2.10.2 Appearance of Finished Work

Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Before erection proceeds, examine with the erector present, the concrete foundation dimensions, concrete and masonry bearing surfaces, anchor bolt size and placement, survey slab elevation, locations of bearing plates, and other embedments to receive structural framing with the metal building manufacturer's templates and drawings before erecting any steel components for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Examine primary and secondary framing to verify that rafters, purlins, angles, channels, and other structural and metal panel support members and anchorages have been installed within alignment tolerances required by metal building manufacturer, UL, ASTM, [ASCE 7-16](#) and as required by the building code for the geographical area where construction will take place.

Examine roughing-in for components and systems penetrating metal roof or wall panels to verify actual locations of penetrations relative to seam locations of metal panels before metal roof or wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Erector, listing conditions detrimental to performance of the Work.

Proceed with erection only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

Provide temporary shoring, guys, braces, and other supports during erection to keep the structural framing secure, plumb, and in alignment against temporary construction loading or loads equal in intensity of the building design loads. Remove temporary support systems when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment and performance.

Miscellaneous Framing: Install sub-purlins, girts, angles, furring, and other miscellaneous support members or anchorage for the metal roof or wall panels, doors, windows, roof curbs, ventilators and louvers according to metal building manufacturer's written instructions.

### 3.3 ERECTION OF STRUCTURAL FRAMING

Erect metal building system according to manufacturer's written erection instructions, approved shop drawings and other erection documents in accordance with [MBMA MBSM](#) - "Metal Building Systems Manual".

Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer and the Contracting Officer.

Set structural framing accurately in locations and to elevations indicated and according to [AISC 325](#) specifications. Maintain structural stability of frame during erection.

Clean and roughen concrete and masonry bearing surfaces prior to setting plates. Clean bottom surface of plates.

Align and adjust structural framing before permanent bolt-up and connections. Perform necessary adjustments and alignment to compensate for changes or discrepancies in elevations.

Maintain erection tolerances of structural framing in accordance with [AISC 360](#).

#### 3.4 METAL WALL PANEL INSTALLATION

Provide metal wall panels of full length from sill to eave as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, in accordance with [MBMA MBSM](#).

Erect wall panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the metal building manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Do not install bent, chipped, or defective sheets.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated eave, and sill.

Work is to allow for thermal movement of the wall panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal wall panels by torch is not permitted.

#### 3.5 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place in accordance with [NRCA RoofMan](#) and [MBMA MBSM](#).

Erect roofing system in accordance with the approved erection drawings, the printed instructions and safety precautions of the metal building manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Do not install bent, chipped, or defective sheets.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake and eave overhang.

Work must allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Field cutting metal roof panels by torch is not permitted.

Roofing sheets must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than **8 inches**; the side laps of standard exterior corrugated sheets must be not less than

2-1/2 corrugations.

Do not permit storage, walking, wheeling, or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of roof construction.

### 3.6 METAL PANEL FASTENER INSTALLATION

Anchor metal panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

### 3.7 FLASHING, TRIM AND CLOSURE INSTALLATION

- a. Comply with performance requirements, manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- b. Sheet metalwork is to be accomplished to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

### 3.8 DOOR AND FRAME INSTALLATION

Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturer's written instructions. Coordinate installation with metal panel flashings and other components. Caulk and seal perimeter of each door frame with elastomeric sealant compatible with metal panels. Comply with installation requirements in Division 08 - OPENINGS.

### 3.9 WINDOW INSTALLATION

Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fastened in place according to manufacturer's written instructions. Coordinate installation with metal panel flashings and other components. Caulk and seal perimeter of each window frame with elastomeric sealant compatible with for metal panels. Comply with installation requirements in Division 08 - OPENINGS.

### 3.10 ACCESSORY INSTALLATION

#### 3.10.1 General

Install accessories with positive anchorage to building and weather-tight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

#### 3.10.2 Dissimilar Metals

Where dissimilar metals contact one another or corrosive substrates are present, protect against galvanic action by painting dissimilar metal

surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each surface, or by other permanent separation techniques as recommended by the metal building manufacturer.

### 3.10.3 Gutters and Downspouts

Comply with performance requirements, manufacturer's written installation instructions, and install sheet metal roof drainage items to produce complete roof drainage system according to [SMACNA 1793](#) recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

### 3.10.4 Insulation

Comply with performance requirements and manufacturer's written installation instructions. Install insulation concurrently with metal panel installation, in thickness indicated to cover entire roof and wall area, as specified in Division 07 - THERMAL AND MOISTURE PROTECTION.

### 3.10.5 Roof and Wall Accessories and Specialties

Install roof and wall accessories and specialties complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports as specified in Division 07 - THERMAL AND MOISTURE PROTECTION, unless otherwise indicated.

## 3.11 CLEAN-UP AND PROTECTION

### 3.11.1 Structural Framing

Clean all exposed structural framing at completion of installation. Remove metal shavings, filings, bolts, and wires from work area. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

### 3.11.2 Metal Panels

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area. Remove protective coverings/films, grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

### 3.11.3 Touch-Up Painting

After erection, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories. Clean and touch-up paint [with manufacturer's touch-up paint] [as specified in Section [09 90 00](#) PAINTS AND COATINGS, unless otherwise indicated].

## 3.12 WASTE MANAGEMENT

Dispose of construction waste in accordance with the requirements of Section [01 74 19](#) CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

### 3.13 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Perform special inspections and testing for seismic-resisting systems and components in accordance with Section 01 45 35 SPECIAL INSPECTIONS. When buildings are classified as Risk Category V, perform special inspections and testing in accordance with UFC 3-301-02.

### 3.14 WARRANTY

#### 3.14.1 [Manufacturer's Warranty](#)

Submit all manufacturers' signed warranties to Contracting Officer prior to final commissioning and acceptance.

#### 3.14.2 [Contractor's Warranty For Installation](#)

Submit warranty for installation to the Contracting Officer prior to final commissioning and acceptance.

#### 3.14.3 Contractor's Five Year No Penal Sum Warranty

CONTRACTOR'S FIVE YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM

FACILITY DESCRIPTION: \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONTRACTOR'S FIVE YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM  
(continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY [ ] FOR A PERIOD OF FIVE [5] [10] [20] [ ] YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING:

FRAMING AND STRUCTURAL MEMBERS, ROOFING AND SIDING PANELS AND SEAMS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS SUCH AS DOORS AND WINDOWS (WHEN FURNISHED BY THE MANUFACTURER), CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM.

ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND UPLIFT DAMAGE MUST BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY MUST BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER.

THIS WARRANTY COVERS THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON [ ] AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President)

\_\_\_\_\_  
(Date)



CONTRACTOR'S FIVE YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM  
(continued)

THE CONTRACTOR HEREBY SUPPLEMENTS THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH IS SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER WHICH INHIBIT FREE DRAINAGE FROM THE ROOF, GUTTERS AND DOWNSPOUTS; OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.
6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES. REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES MUST BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, MUST BE INITIATED IMMEDIATELY; A WRITTEN PLAN MUST BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT MUST BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED

CONTRACTOR'S FIVE YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM  
(Exclusions from Coverage Continued)

POST A FRAMED COPY OF THIS WARRANTY IN THE MECHANICAL ROOM OR OTHER APPROVED  
LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

## SECTION 13 49 20.00 10

## RFI/EMI SHIELDING

10/07

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2017) Steel Construction Manual

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.18/A5.18M (2021) Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding

AWS BRH (2007; 5th Ed) Brazing Handbook

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

AWS D9.1/D9.1M (2018) Sheet Metal Welding Code

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

## ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A227/A227M (2017) Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs

ASTM A568/A568M (2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B194	(2008) Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B545	(2013; R 2021) Standard Specification for Electrodeposited Coatings of Tin
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book
IEEE 299	(2006; R 2012) Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures
IEEE C62.11	(2020) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE C62.33	(2016) Test Methods and Performance Values for Metal-Oxide Varistor Surge Protective Components
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and

## Systems: Enclosures

NEMA MG 1 (2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

NFPA 77 (2014) Recommended Practice on Static Electricity

NFPA 80 (2022) Standard for Fire Doors and Other Opening Protectives

NFPA 80A (2022) Recommended Practice for Protection of Buildings from Exterior Fire Exposures

NFPA 101 (2021) Life Safety Code

NFPA 780 (2023) Standard for the Installation of Lightning Protection Systems

## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-HDBK-419 (1987; Rev A) Grounding, Bonding, and Shielding for Electronic Equipments and Facilities Volumes 1 of 2 Basic Theory

MIL-STD-188-124 (1998; Rev B; Notice 2 1998; Notice 3 2000; Notice 4 2013) Grounding, Bonding and Shielding for Common Long Haul/Tactical Communications Systems, Including Ground Based Communications - Electronics Facilities and Equipments

MIL-STD-188-125-1 (1998; Rev A; Notice 1 2021) High-Altitude Electromagnetic Pulse (HEMP) Protection for Ground-Based Facilities Performing Critical, Time-Urgent Missions, Part I Fixed Facilities

MIL-STD-220 (2009; Rev C; Notice 1 2014; Notice 2 2019) Method of Insertion Loss Measurement

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

## UNDERWRITERS LABORATORIES (UL)

UL 486A-486B (2018; Reprint May 2021) UL Standard for Safety Wire Connectors

UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2021) UL Standard for Safety Surge Protective Devices

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Installation; G[, [\_\_\_\_]]  
Approved Drawings; G[, [\_\_\_\_]]

### SD-03 Product Data

EM Shielding System; G[, [\_\_\_\_]]  
Installation; G[, [\_\_\_\_]]  
Quality Control Plan; G[, [\_\_\_\_]]  
Qualifications; G[, [\_\_\_\_]]  
Qualifications of Welders; G[, [\_\_\_\_]]  
EM Door; G[, [\_\_\_\_]]  
Filter Assemblies; G[, [\_\_\_\_]]  
Penetrations; G[, [\_\_\_\_]]

### SD-06 Test Reports

Impulse Sparkover Voltage  
ESA Extinguishing Test  
ESA Extreme Duty Discharge Test  
Field Testing

### SD-07 Certificates

Qualifications of Welders

### SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals; G[, [\_\_\_\_]]  
Service Organization; G[, [\_\_\_\_]]

## 1.3 QUALITY ASSURANCE

Work performed under this section shall be supervised and inspected by the shielding specialist. Materials and equipment shall be approved and verified by the shielding specialist before being submitted to the Contracting Officer for approval. The submittal shall be date stamped and signed by the shielding specialist. The shielding specialist shall be responsible for coordinating the required shielding work with the work of all other trades that will interface or affect the shielding work in any way.

### 1.3.1 Shielding Specialists, Installers and Testing Specialists

Provide the name and background **qualifications** of individuals who will be responsible for installation, supervision, and testing of the shielding systems on this project. Shielding and testing specialist credentials shall include a bachelor's degree in science or engineering and post-degree training and experience with EM shielding.

#### 1.3.1.1 Testing Experience

The testing specialist shall have experience during the previous 5 years in shielded enclosure leak detection system (SELDS), **IEEE 299**, and other methods of shielded enclosure testing.

#### 1.3.1.2 Work Experience

The EM shielded system shall be provided by an experienced firm or individual that has been regularly and successfully engaged in the installation, supervision, and/or testing of equivalent EM shielded systems for at least the previous 5 years. The principal work of this firm or individual shall be the satisfactory installation and construction of EM shielded protection systems. Such experience shall include achieving specified requirements for shielded system attenuation and maintainability of attenuation levels on work performed.

#### 1.3.1.3 Project Experience

Furnish a project experience list on projects of similar scope which have been completed during the previous 5 years. Include project completion dates and the name and telephone number of the user and/or owner of each project. Project experience for installers shall indicate the installation responsibilities, performance, materials, and methods used. Project experience for the shielding specialist shall indicate the responsibilities performed. Project experience for the testing specialist shall indicate the test methods performed.

### 1.3.2 **Qualifications of Welders**

Welding shall be performed by certified welders. Provide the names of the welders to be employed and certification that each welder has passed qualification tests within the last 2 years in the processes specified in **AWS D1.1/D1.1M**, **AWS D9.1/D9.1M**, and as required by the Contracting Officer.

### 1.3.3 Filter and Electrical Work Requirements

Filter and electrical work shall comply with **NFPA 70**, **UL 486A-486B**, and **UL 1283**. The label and listing of the Underwriters Laboratories or other nationally recognized testing laboratory will be acceptable evidence that the material or equipment conforms to the applicable standards of that agency. In lieu of the label or listing, a certificate may be furnished from an acceptable testing organization adequately equipped and competent to perform such services. The certificate shall state that the items have been tested and that they conform to the specified standard.

### 1.3.4 Field Samples

Provide field samples for the following: [shielding sheet installation,] [shielding fastening,] [doors,] [[30] [100] [\_\_\_\_\_] ampere power filter,] [communication filter,] [waveguide,] [penetration,] and [\_\_\_\_\_].

### 1.3.5 Pre-Installation Meeting

Hold a pre-installation meeting with the subcontractors and installers working in, on, or near the EM shield. Discuss coordination requirements and instructions shall be stated to ensure the integrity of the EM shield.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and stored from excessive humidity and temperature variation, dirt, and other contaminants.

### 1.5 PROJECT/SITE CONDITIONS

Perform welding of EM shielding material and sheet steel at an ambient temperature of 50 degrees F minimum to 90 degrees F. Shielding shall not be installed until the building has been weather enclosed. Sheet steel welding shall not be performed in direct sunlight.

### 1.6 MAINTENANCE

#### 1.6.1 Maintenance Supplies and Procedures

Provide maintenance supplies sufficient for a [3] [\_\_\_\_\_] year period or [50,000] [\_\_\_\_\_] open-close cycles, whichever is greater, for each EM shielded door. The maintenance instructions required to maintain the door through the cycle count shall be prominently displayed nearby.

#### 1.6.2 Extra Materials

##### 1.6.2.1 Filters

[One extra EM power filter] [[\_\_\_\_\_] extra EM power filters] and [one extra communications filter] [[\_\_\_\_\_] extra communications filters] of each different type furnished on the project shall be furnished as a spare.

##### 1.6.2.2 EM Shielded Doors

Furnish one set of finger stock and EM gaskets (if used) for each hinged EM shielded door provided. In addition, provide one set of manufacturer recommended and Contracting Officer approved spare parts for EM shielded doors of each style installed.

##### 1.6.2.3 Tools

Furnish one full set of tools that are required to maintain the doors and are not typically available from tool vendors. Furnish environmentally safe lubricants, cleaning solvents, or coatings in sufficient quantities to last for [6] [\_\_\_\_\_] months.

##### 1.6.2.4 Special Tools

Provide one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment as follows: [SELDS Test Set] [\_\_\_\_\_] [\_\_\_\_\_]

#### 1.6.3 Operating and Maintenance Manuals

Submit manufacturer's written instructions for operation and maintenance of



EM Shielding system. The manual shall address all components and aspects of the EM shielding and shall include, but not be limited to, the following:

- a. A complete set of assembly drawings to include penetration locations and installation details.
- b. The construction specification on EM shielding.
- c. Shield penetration schedule.
- d. Power/signal filter schedule.
- e. Test plan.
- f. The prepared preventive maintenance instructions for periodic inspection, testing and servicing, lubrication, alignment, calibration, and adjustment events normally encountered. Complex preventive maintenance events shall be extracted from or shall refer to detailed vendor or manufacturer data. This information shall be derived from an evaluation of engineering data considering local environmental conditions, manufacturer's recommendations, estimated operating life for the specific application and use of the equipment, and types of job skills available at the operating site.
- g. Spare parts data approved and verified by the shielding specialist prior to submission. The data shall include a complete list of recommended parts and supplies with current unit prices and source of supply.
- h. Provide a list of hardness critical items (HCI) requiring periodic inspection to maintain EM shield integrity. Hardness critical items are those components and/or construction features which singularly and collectively provide specific levels of HEMP protection, such as the EM shield, surge arresters, EM shielded doors, shield welding, electrical filters, honeycomb waveguides, and waveguides-below-cutoff.

## PART 2 PRODUCTS

### 2.1 SYSTEM REQUIREMENTS

#### 2.1.1 General

The shielded facility shall meet or exceed minimum attenuation decibel (dB) levels specified. The EM shielding system shall include, but is not limited to, the following:

- a. The [welded steel] [bolted] EM shield.
- b. EM shielded doors for access into the facility.
- c. Electrical and electronic penetrations of the shield.
- d. EM filter/surge arrester assemblies, including their EM enclosures.
- e. EM shielded pull boxes and junction boxes.
- f. EM shielded conduit runs.
- g. Special protective measures for mission-essential equipment outside the

EM shield.

- h. Structural penetrations.
- i. Mechanical and utility penetrations (such as air ducts, gas, and water).
- j. Instrumentation and control.
- k. Equipment door/access panels.
- l. Sufficient supervisory and/or quality control personnel onsite to supervise the installation crew and to conduct in-progress quality assurance tests.

#### 2.1.2 Factory Tests

Perform factory tests as specified. The Contracting Officer reserves the right to witness the specified factory tests. Notify the Contracting Officer at least 30 days before factory tests are scheduled to be performed. Test data shall include a detailed description of the test instrumentation and equipment, including calibration dates, a detailed description of the test procedure, and the recorded test data.

### 2.2 MATERIALS AND EQUIPMENT

#### 2.2.1 Standard Products

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Support equipment by a [service organization](#) that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 2.2.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### 2.2.3 Testability

Equipment and materials of the EM shielding shall be designed and built to facilitate testing and maintenance.

### 2.3 EM SHIELDING EFFECTIVENESS

The EM shielded enclosure complete with all filters, doors, and/or waveguides shall have the following minimum EM shielding effectiveness attenuation. Minimum magnetic field attenuation shall be [20 dB] [\_\_\_\_\_] at 14 kHz increasing linearly to [50 dB] [100 dB] at [200 kHz] [1 MHz] [\_\_\_\_\_] . Minimum electric field and plane wave attenuation shall be [50 dB] [100 dB] [\_\_\_\_\_] from 14 kHz to [1 GHz] [10 GHz] [\_\_\_\_\_] .

### 2.4 EM SHIELDING ENCLOSURE REQUIREMENTS (WELDED CONSTRUCTION)

#### 2.4.1 Welded Shielding Enclosure

The intent of this section and the drawings is to provide a complete metal

enclosure including floor, walls, ceiling, doors, penetrations, welds, and the embedded structural members to form a continuous EM shielded enclosure. Shielding sheets and closures shall be [10] [\_\_\_\_\_] gauge thick hot-rolled steel conforming to ASTM A568/A568M. Steel plates, channels, or angles of minimum 1/4 inch thick shall be used to reinforce shield sheets for attachments of ducts, waveguides, conduit, pipes, and other penetrating items. Furring channels used to attach shielding sheets to walls or floors shall be the minimum gauge of the shielding steel. The shielding sheet steel gauge may be thicker at the Contractor's option to reduce labor and welding effort only if structurally tolerable with the existing design. Steel shall be free of oil, dents, rust, and defects.

#### 2.4.2 Metal Members

Structural steel shapes, plates, and miscellaneous metal shall conform to ASTM A36/A36M.

#### 2.4.3 Steel and Welding Material

Welding materials shall comply with the applicable requirements of AWS D1.1/D1.1M and AWS D9.1/D9.1M. Steel and welding material shall conform to AISC 325. Welding electrodes shall conform to AWS D1.1/D1.1M for metal inert gas (MIG) welding method. Weld filler metal shall conform to AWS A5.18/A5.18M.

#### 2.4.4 Fasteners

Self-tapping screws shall not be used for attachment of shielding. Power-actuated drive pins shall be zinc-coated steel, Type I, pin size No. 4 to secure steel sheets to concrete surfaces and to light gauge furring channels. The drive pins shall conform to ASTM A227/A227M Class 1 for materials and ASTM B633 for plating.

#### 2.4.5 Miscellaneous Materials and Parts

Miscellaneous bolts and anchors, supports, braces, and connections necessary to complete the miscellaneous metal work shall be provided. The necessary lugs, rebars, and brackets to assemble work shall be provided. Holes for bolts and screws shall be drilled or punched. Poor matching of holes will be cause for rejection. Thickness of metal and details of assembly and supports shall provide ample strength and stiffness. The materials shall be galvanically similar.

#### 2.4.6 Penetrations

Penetrations of the shield, including bolts or fasteners, shall be sealed with puddle welds or full circumferential EM welds. Structural penetrations including beams, columns, and other metallic structural elements shall be provided with continuously welded or brazed seams and joints between the penetrating element and the shield. Nonmetallic structural elements shall not penetrate the electromagnetic barrier.

#### 2.4.7 Penetration Plates (Welded Construction)

The penetration plate shall be the central location for treatment of penetrations. The panel shall be constructed of 1/4 inch thick ASTM A36/A36M steel plate welded to the shield. Waveguide, conduit, and piping penetrations shall be circumferentially welded at the point of penetration to the inner surface of the penetration plate. Penetration

plates shall extend at least 6 inch beyond all penetrations.

#### 2.4.8 Floor Finish

Floor EM shielding shall be covered by a reinforced cast-in-place concrete slab [4] [\_\_\_\_\_] inch thick. Seismic requirements shall be [in accordance with UFC 3-301-01 and Sections 13 48 73 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT and 23 05 48.19 [SEISMIC] BRACING FOR HVAC and [09 69 13 RIGID GRID ACCESS FLOORING] [09 69 19 STRINGERLESS ACCESS FLOORING] (if needed)].

### 2.5 EM SHIELDING ENCLOSURE REQUIREMENTS (BOLTED CONSTRUCTION)

#### 2.5.1 Panel Construction

Flat steel sheets shall be laminated to each side of a 3/4 inch thick structural core of either plywood or hardboard. Panels shall have a flame spread rating of less than 25 when tested according to ASTM E84. Flat steel shall conform to ASTM A653/A653M with G-60 coating, minimum 26 gauge thick, zinc-coated phosphatized. Plywood shall conform to APA L870 for exterior, sound grade hardwood, Type I. Hardboard shall conform to AHA A135.4, Class 4, SIS, for standard type hardboard. Adhesive for laminating steel sheets to structural core shall be a waterproof type which maintains a permanent bond for the lifetime of the enclosure.

#### 2.5.2 Framing

Panels shall be joined and supported by specially designed framing members that clamp the edges of the panels and provide continuous, uniform, and constant pressure for contact to connect the shielding elements of the panels. The walls shall be self supporting from floor to ceiling with no bracing. Deflection of walls under a static load of 75 pounds applied normally to the wall surface at any point along the framing members shall not exceed 1/250 of the span between supports. [Ceilings shall be self-supporting from wall to wall.] [Ceilings shall be supported by adjustable, nonconducting, isolated hangers from the structural ceiling above.] Ceilings shall be designed to have a deflection under total weight, including ceiling finish, of not more than 1/270 of the span. A one-piece factory pre-welded corner section or trihedral corner framed with a brass machine cast corner cap assembly consisting of inner and outer parts shall be provided at all corner intersections of walls and floor or ceiling. The modular enclosure shall be designed for ease of erection, disassembly, and reassembly.

#### 2.5.3 Channel

The framing-joining system members shall consist of 1/8 inch thick zinc-plated steel channels having a minimum 5/8 inch overlap along each side of the contacting surface. Screw fasteners shall be spaced at 3 or 4 inch intervals. Screw fasteners shall be either zinc or cadmium-plated steel, minimum size 1/4 inch, with a pan or flat Phillips head. Fasteners shall be heat-treated and hardened with a minimum tensile strength of 135,000 psi.

#### 2.5.4 Sound Transmission Class (STC)

Enclosure panels shall have an STC of [30] [\_\_\_\_\_] dB minimum when tested according to ASTM E90.

#### 2.5.5 Penetration Plates (Bolted Construction)

Plates shall be a minimum 1/8 inch thick ASTM A36/A36M steel plate, sized [18] [\_\_\_\_\_] by [18] [\_\_\_\_\_] inch and shall have a 1/4 inch thick extruded brass frame for mounting to the shielded enclosure wall panel. Penetration plates shall extend at least inch beyond all penetrations.

## 2.6 EM SHIELDED DOORS

### 2.6.1 General

Material in shielded doors and frames shall be steel conforming to ASTM A36/A36M or ASTM A568/A568M and shall be stretcher-leveled and installed free of mill scale. Metal shall be thicker where indicated or required for its use and purpose. Metal thresholds of the type for proper shielding at the floor shall be provided. Fire rated shielded doors and assemblies shall meet NFPA 80 and NFPA 80A requirements and shall bear the identifying label of a nationally recognized testing agency qualified to perform certification programs. The EM shielded doors shall be provided by a single supplier who has been regularly engaged in the manufacture of these items for at least the previous 5 years. The assemblies shall be supplied complete with a rigid structural frame, hinges, latches, and parts necessary for operation. The products supplied shall duplicate assemblies that have been in satisfactory use for at least 2 years. The door frame shall be steel suitable for [welding] [bolting] to the surrounding structure and shield. The EM filters, EM waveguide penetrations for door systems, and miscellaneous material shall be provided for a complete system. The enclosure door shall be nonsagging and nonwarping. The EM shielded door shall provide a shielding effectiveness of [10 dB] [20 dB] greater than the minimum EM shielding effectiveness requirements. The door shall have a clear opening [as shown on the drawings] [of [36] [\_\_\_\_\_] inch wide and [84] [\_\_\_\_\_] inch high]. The door and frame assembly shall have a sound rating of STC [30] [\_\_\_\_\_] minimum. Testing shall be performed in accordance with ASTM E90.

#### 2.6.1.1 Door Latch

The door latch shall be lever controlled with roller cam action requiring not more than 15 pounds of operating force on the lever handle for both opening and closing. The door shall be equipped with a latching mechanism having a minimum of three latching points that provides proper compressive force for the EM seal. The mechanism shall be operable from both sides of the door and shall have permanently lubricated ball or thrust bearings as required at points of pivot and rotation.

#### 2.6.1.2 Hinges

Doors shall be equipped with a minimum of three well-balanced adjustable ball-bearing or adjustable radial thrust bearing hinges suitable for equal weight distribution of the shielded doors. Hinges shall allow adjustment in two directions. Force necessary to move the doors shall not exceed 5 pounds.

#### 2.6.1.3 Threshold Protectors

Threshold protectors shall be furnished for each EM shielded door. Protectors shall consist of portable ramps that protect the threshold when equipment carts or other wheeled vehicles are used to move heavy items across the threshold. The ramps may be asymmetrical to account for different floor elevations on each side, but the slope of the ramp shall

not exceed 4:1 on either side. Ramps shall be designed to support a [500] [\_\_\_\_\_] pound vertical force applied to a 3 by 1/2 inch area for a personnel door, and a [2,000] [\_\_\_\_\_] pound vertical force applied to a 3 by 1/2 inch area for an equipment double leaf door. The force shall be applied to the contact area between the threshold and the door. Mounting brackets, convenient to the entry, shall be provided to store the ramp when not in use.

#### 2.6.1.4 Frequency of Operation

With proper maintenance, door assemblies shall function properly through 100,000 cycles and 15-year service life minimum without the shielding effectiveness decreasing below the overall shield required attenuation.

#### 2.6.1.5 Electric Interlocking Devices

Electric interlocking devices shall be provided for vestibules equipped with shielded doors at each end. Electric interlocking devices shall be provided so that shielded doors at the ends of the vestibule cannot be opened at the same time during normal operation. A manual override shall be provided to allow emergency egress, and an audible alarm shall be provided to indicate that doors at each end of the vestibule are open. The alarm will continue to sound while both doors are open. Provide a low-piezoelectric-type alarm, in a tamperproof enclosure, at a location shown on the project drawings or as directed by the Contracting Officer's representative. The sound intensity shall be 45 dBA minimum at 10 feet. Lights shall be provided on the side of each door outside the vestibule to indicate that the other door is open. Interlock systems may be integrated into a cypher lock system. The interlock system shall be powered by an uninterruptible power source and shall be fail-safe in an unlocked condition in the event of a power failure.

#### 2.6.1.6 Electric Connectivity

Electric connectivity for sensors, alarms, and electric interlocking devices shall be installed in accordance with the door manufacturer's instructions, the approved drawings, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Submit detail drawings showing location, number, and method of penetrating the shielding material. Fabrication details for penetrations of the shielding material and the complete EM shielded enclosure to include doors and filters. Drawings shall show erection details and sequence of erection and shall clearly indicate the methods necessary to ensure shield integrity under all columns and other structural members.

#### 2.6.1.7 Threshold Alarm

A press-at-any-point ribbon switch shall be applied to the threshold. The switch shall enunciate an alarm whenever pressure is applied to the threshold of the EM shielded door.

#### 2.6.1.8 Hold Open and Stop Device

Each EM shielded door leaf shall be provided with a hold open and stop device permanently attached to the door leaf. Shielded doors shall have a fastener plate welded onto the door. The device shall not interfere with the finger stock. Drilling or tapping of the shielded door will not be allowed.

#### 2.6.1.9 Emergency Exit Hardware

Emergency exit EM shielded doors shall be equipped with single motion egress hardware. The force required to latch and unlatch emergency exit hardware on EM shielded doors shall meet life safety code [NFPA 101](#). Field alterations or modifications to panic hardware will not be allowed.

#### 2.6.1.10 Finish

EM shielded doors shall be factory prime painted with zinc chromate primer. Doors may be factory finish painted or galvanized. Touch up any damaged finish.

#### 2.6.1.11 Door Counter

A door operation counter shall be provided on the enclosure interior.

#### 2.6.1.12 Additional Hardware

See door schedule on drawings and Section [08 71 00 DOOR HARDWARE](#), for additional hardware requirements. Fire rating and STC sound ratings shall be as required by the door finish schedule on the drawings or in the specifications.

#### 2.6.2 Latching Type Doors

Doors shall be [steel] [laminated] type. [Steel doors shall be a minimum of [10 gauge](#) thick steel sheet electrically and mechanically joined by welded steel frames overlapping joints with continuous EM welds.] [Laminated type shall be the same construction as enclosure panels, except the steel faces shall be electrically and mechanically joined by channels or overlapping seams, both of which shall be continuously seam welded or soldered along all joined surfaces.] The closure seal shall utilize an extruded brass channel containing a recess into which [two] [\_\_\_\_\_] sets of [beryllium copper condition HT in accordance with [ASTM B194](#)] [stainless steel 430 (magnetic type) series] contact fingers and a closed cell foam rubber air seal are fitted and can be easily removed and replaced without the use of special tools and without the application of solders. The door shall mate to the frame in a manner that allows the insertion of a brass knife edge between the two rows of the radio frequency finger stock, to obtain optimum conductivity and electromagnetic shielding. High-temperature silver solder shall be used to attach the brass knife edge components to the door panels and the frame. The fingers that form a contact between the door and its frame shall be protected from damage due to physical contact and shall be concealed within the door and frame assembly.

#### 2.6.3 Pneumatic Sealing Doors

Pneumatic sealing mechanisms shall achieve EM shielding by using pressure to force the door panel against the frame surface. Contact areas of door and frame shall be a peripheral strip not less than [3 inch](#) wide completely around the door with a tinned or highly conductive noncorrosive surface. After the door is in a closed position, the pneumatic sealing mechanism shall exert pressure in not more than 10 seconds. The sealing mechanism release shall be actuated in not more than 5 seconds. Manual [override] [operation] shall not exceed a maximum of [\[35\] \[\\_\\_\\_\\_\\_\] pounds](#). When the door is sealed, the attenuation around the edges shall meet the EM shielding effectiveness requirements of this specification. Swinging doors shall have a threshold of zinc-plated steel, not less than [3/8 inch](#) thick.

The door shall be provided with a pneumatic system that maintains a nominal sealing pressure of [35] [\_\_\_\_\_] psi. A label shall be attached to pneumatic doors warning against painting of the mating surfaces.

#### 2.6.3.1 Door and Enclosure Design

Doors shall be designed for long life and reliability without the use of EM gaskets, EM finger stock, or other sealing devices other than the direct metal-to-metal contact specified. The EM sealing device shall be fail-safe upon loss of air pressure and shall readily allow manual opening of the door. For either normal or fail-safe operation, the maximum time to reach the open position shall be no more than 7 seconds. The enclosure design shall include provision for removing the door for routine maintenance without disturbing its alignment and EM sealing properties.

#### 2.6.3.2 Control Panel

The inside and outside of the shielded enclosure shall contain a control panel including the necessary opening and closing pneumatic valves. The outside control panel shall also have a pressure regulator and filter. The door air supply shall be capable of quick opening from inside the enclosure to allow escape when opening pneumatic valves fail or malfunction.

#### 2.6.3.3 Air System for Pneumatic Sealing

A complete air system including compressor, filter alarm, tank, lines, air filter, dryer, air control valves, and controls shall be provided. Air tank capacity shall be sized so that the air volume and pressure are sufficient to operate the door through ten complete cycles after the loss of normal power.

#### 2.6.4 Magnetic Sealed Door Type

An EM seal shall be formed by a solid metal-to-metal contact around the periphery of the door frame. The materials at the contact area shall be compatible and corrosion resistant. The contact force for the door EM seal shall be provided by electromagnets. When the electromagnet is energized, the door leaf shall be pulled in to ensure a solid and continuous contact with the door frame. When the electromagnet is de-energized, the door leaf shall be free to swing. The EM shielded doors may use electromagnets or a combination of permanent magnets and electromagnets.

#### 2.6.5 Sliding Type Door

A sliding shielded door shall be of the size and operating direction indicated. Clear openings indicated on the drawings shall not require dismantling of any part of the door. The door shall be manually operable from either side, inside or outside, with a maximum pull (force) of 35 pounds to set the shielded door in motion. Shielded door face panels and frames shall be constructed of reinforced steel suitable for achieving the specified attenuation. Frames shall be constructed of steel shapes welded together to form a true rectangular opening. In the sealed position, the shielded doors shall provide the minimum shielding effectiveness specified without any derating. The doors shall be designed for long life and reliability and shall not use EM gaskets, EM finger stocks, or other sealing devices other than the specified direct metal-to-metal contact. A label shall be attached to sliding doors warning against painting of the mating surfaces.



### 2.6.6 Power Operators

Power operators shall be [pneumatic] [electric] type conforming to **NFPA 80** and the requirements specified. Readily adjustable limit switches shall be provided to automatically stop the door in its full open or closed position. All operating devices shall be suitable for the hazardous class, division, and group defined in **NFPA 70**.

#### 2.6.6.1 Pneumatic Operators

Pneumatic operators shall be heavy-duty industrial type designed to operate the door at not less than  $2/3$  fps or more than 1 fps with air pressure of [\_\_\_\_\_] psi. A pressure regulator shall be provided if the operator is not compatible with available air pressure. Dryer, filter, and filter alarm shall be provided. Pneumatic piping shall be provided up to the connection with building compressed air, but not more than 20 feet from door jambs. Operators shall have provisions for immediate emergency manual operation of the door in case of failure. The operator shall open, close, start, and stop the door smoothly. Control shall be [electrical, conforming to **NEMA ICS 2** and **NEMA ICS 6**; enclosures shall be Type 12 (industrial use), Type 7 or 9 in hazardous locations, or as otherwise indicated] [pneumatic] [with] [pushbutton wall switches] [ceiling pull switches] [rollover floor treadle] [as indicated].

#### 2.6.6.2 Electric Operators

Electric operators shall be heavy-duty industrial type designed to operate the door at not less than  $2/3$  fps or more than 1 fps. Electrical controls shall be [pushbutton wall switches] [ceiling pull switches] [rollover floor treadle] [as indicated]. Electric power operators shall be complete with an electric motor, brackets, controls, limit switches, magnetic reversing starter, and other accessories necessary. The operator shall be designed so that the motor may be removed without disturbing the limit switch timing and without affecting the emergency operator. The power operator shall be provided with a slipping clutch coupling to prevent stalling of the motor. Operators shall have provisions for immediate emergency manual operation of the door in case of electrical failure. Where control s differ from motor voltage, a control voltage transformer shall be provided inside as part of the starter. Control voltage shall be 120 volts or less.

##### 2.6.6.2.1 Motors

Drive motors shall conform to **NEMA MG 1**, shall be high-starting torque reversible type, and shall be of sufficient output to move the door in either direction from any position at the required speed without exceeding the rated capacity. Motors shall be suitable for operation on [[120] [208] [277] [480] volts, 60 Hz] [[220] [240] [380] volts, 50 Hz], [single] [three] phase, and shall be suitable for across-the-line starting. Motors shall be designed to operate at full capacity over a supply variation of plus or minus 10 percent of the motor voltage rating.

##### 2.6.6.2.2 Controls

Each door motor shall have an enclosed reversing across-the-line type magnetic starter with thermal overload protection, limit switches, and remote control switches. The control equipment shall conform to **NEMA ICS 2**; enclosures shall conform to **NEMA ICS 6**, and shall be Type 12 (industrial use), Type 7 or 9 in hazardous locations, or as otherwise indicated. Each wall control station shall be of the three-button type, with the controls

marked and color coded: OPEN - white; CLOSE - green; and STOP - red. When the door is in motion and the stop control is pressed, the door shall stop instantly and remain in the stop position. From the stop position, the door shall be operable in either direction by the open or close controls. Controls shall be of the full-guarded type to prevent accidental operation.

#### 2.6.6.3 Leading Edge Safety Shutdown

Leading edges of the door with operators shall have a safety shutdown switch strip the entire length of the leading edge. The safety strip shall be press-at-any-point ribbon switches. Activation of the strip shall shut down the operator and release the door with reset required to continue door operation.

#### 2.6.7 EM Shielded Door Factory Test

Test data shall be provided on at least one shielded door of each type provided for the facility to verify that the EM shielded doors of the design supplied have been factory tested for compliance with this specification. Test doors shall not be furnished on the project. Test data reports shall be submitted in accordance with paragraph SUBMITTALS.

##### 2.6.7.1 Swinging Door Static Load Test

The door shall be mounted and latched to its frame, then set down in a horizontal position such that it will open downward with only the frame rigidly and continuously supported from the bottom. A load of 40 lb/psf shall be applied uniformly over the entire surface of the door for at least 10 minutes. The door will not be acceptable if this load causes breakage, failure, or permanent deformation which causes the clearance between door leaf and stops to vary more than 1/16 inch from the original dimension.

##### 2.6.7.2 Swinging Door Sag Test

The door and its frame shall be installed normally and opened 90 degrees. Two 100 pound weights, one on each side of the door, shall be suspended from the door within 5 inch of the outer edge for at least 10 minutes. The door will not be acceptable if this test causes breakage, failure, or permanent deformation which causes the clearance between the door leaf and door frame to vary more than 1/16 inch from the original dimension.

##### 2.6.7.3 Door Closure Test

Each door design shall be operated 100,000 complete open-close cycles. The door will not be acceptable if the closure test causes any breakage, failure, or permanent deformation which causes the clearance between the door and door frame to vary more than 1/16 inch from the original dimension.

##### 2.6.7.4 Handle-Pull Test

The door shall be mounted and latched to its frame. The handle shall have a force of 250 pounds applied outward (normal to the surface of the door) at a point within 2 inch of the end of the handle. The door will not be acceptable if this test causes any breakage, failure, or permanent deformation exceeding 1/8 inch.

##### 2.6.7.5 Door Electromagnetic Shielding Test

The EM shielded door shall be factory tested in accordance with the

requirements of this specification both before and after the mechanical tests described above.

## 2.7 ELECTROMAGNETIC FILTERS

A filter shall be provided for each power, data, and signal line penetrating the enclosure. These lines shall include, but are not limited to, power lines, lines to dummy loads, alarm circuits, lighting circuits, and signal lines such as telephone lines, antenna lines, HVAC control, and fire alarm. Filters [and ESAs] shall be enclosed in metallic cases which shall protect the filter elements from moisture and mechanical damage. All external bonding or grounding surfaces shall be free from insulating protective finishes. All exposed metallic surfaces shall be suitably protected against corrosion by plating, lead-alloy coating, or other means. The finish shall provide good electrical contact when used on a terminal or as a conductor, shall have uniform texture and appearance, shall be adherent, and shall be free from blisters, pinholes and other defects. The filter [and ESA] assemblies shall also meet the requirements of [UL 1283](#). Insertion loss in the stop band between the load side of the filter and the power supply side shall be not less than the EM shielding attenuation specified. The filter used for 400 Hz shall be provided with power factor correcting coil to limit the reactive current to 10 percent maximum of the full load current rating. Each filter unit shall be capable of being mounted individually and shall include one filter for each phase conductor of the power line and the neutral conductor. The signal filters shall include one filter for each conductor.

### 2.7.1 Enclosure

Filter units shall be mounted in an EM modified NEMA Type [1] [\_\_\_\_\_] enclosure in accordance with [NEMA ICS 6](#) and meet the requirements of [UL 1283](#). Enclosures shall be made of corrosion resistant steel of 14 gauge minimum thickness with welded seams and galvanized bulkhead cover plates. The enclosure nonconductive surfaces shall be finished with a corrosion-inhibiting primer and two coats of baked or finish enamel. The input compartment shall house the individual line filters and the input terminals of the filters and mounting for the surge arrestor. Live parts shall be spaced in accordance with [NFPA 70](#). Filter leads shall be copper. Filter enclosures shall be shielding effectiveness tested in accordance with [IEEE 299](#) and Table I of this specification. [Test leads and coaxial connectors through the enclosure shall be provided for HEMP testing.] [The imbedded configuration shall be used for filter enclosures as required by [MIL-STD-188-125-1](#).]

#### 2.7.1.1 Filter Unit Mounting

Each filter unit shall be mounted individually in an enclosure containing one filter for each penetrating conductor. One end of the individual filter case shall be attached to the rf barrier plate between the two compartments to provide a rf tight seal between the rf barrier plate and the filter case. The terminals of the filters shall project through openings in the rf barrier plate into the inner terminal compartment. The case of each filter shall be attached to both the enclosure and to the barrier plate to prevent undue stress being applied to the rf seal between the filter case and the rf barrier plate. Individual filters shall be removable from the enclosure. Like filters shall be interchangeable.

#### 2.7.1.2 Conduit Connections to Enclosures

The load terminal and input compartments shall have no knockouts, and each compartment shall have weldable threaded conduit hubs. The hubs shall be circumferentially EM welded in place and shall be sized and located as required for the conduits indicated.

#### 2.7.1.3 Access Openings and Cover Plates

Enclosures shall have separate clear front access cover plates on terminal and power input compartments. Access cover plates shall be hinged with EM gaskets and 3 inch maximum bolt spacing. The design shall include thick cover plates and folded enclosure edges to prevent enclosure deformation, bolt spacers to prevent uneven gasket compression, and gasket mounting to facilitate replacement. All gasket contact areas shall be tin-plated using the electrodeposited type I method in accordance with ASTM B545. Nuts and bolts shall be permanently fastened to the enclosure by welding or captive attachments.

#### 2.7.1.4 Operating Temperature

The filter and ESA assembly shall be rated for continuous operation, with filters at rated voltage and full-load currents, in ambient temperatures from minus 55 to plus 65 degrees C (measured outside the EM filter enclosure). Filter components shall be suitable for continuous full load operation at a temperature from minus 55 to plus 85 degrees C.

#### 2.7.1.5 Short Circuit Withstand

Filters shall be labeled and built to have standard short circuit withstand ratings in accordance with UL 1283. The minimum ratings shall be as follows:

FILTER RATED CURRENT, RMS AMPERE	SHORT CIRCUIT FULL LOAD AMPERES SYMMETRICAL
0-100	10,000
101-400	14,000

#### 2.7.1.6 Filter Connections

Individual filters shall have prewired standoffs and solderless lugs. The lugs shall be of the hexagonal head bolt or screw type and shall conform to UL 486A-486B. Live parts shall be spaced in accordance with NFPA 70.

### 2.7.2 Internal Encapsulated Filters (Filter Units)

#### 2.7.2.1 Filter Construction

Individual filters shall be heavy-duty type sealed in a steel case. After the filter is filled with an impregnating or encapsulating compound, the seams shall be welded. When a solid potting compound is used to fill the filter, the filters may be mechanically secured and sealed with solder. Hermetically sealed impregnated capacitors shall be used, or the complete filter assembly shall be vacuum impregnated. Individual filter cases shall be fabricated of not less than 14 gauge thick steel and finished with a corrosion-resistant plating, or one coat of corrosion-resistant primer and two coats of finish enamel. The filter shall be filled with an

impregnating or potting compound that is chemically inactive with respect to the filter unit and case. The compound, either in the state of original application or as a result of having aged, shall have no adverse effect on the performance of the filter. The same material shall be used for impregnating as is used for filling. Filter terminals shall be copper that can withstand the pull requirements specified and measured in accordance with paragraph ELECTROMAGNETIC FILTERS.

#### 2.7.2.2 Ratings

[Filters shall be provided in the current, voltage, and frequency ratings indicated on the drawings.] [Filter current shall be [\_\_\_\_].] [Filter voltage shall be [[120] [208] [277] [480] volts, 60 Hz] [[230] [250] [400] volts, 50 Hz].] [The pass band frequencies [\_\_\_\_] Hz to [\_\_\_\_] Hz shall be suitable for use with the [50] [60] [\_\_\_\_] [and] [400] [\_\_\_\_] Hz power source and signal line filters as indicated.]

#### 2.7.2.3 Voltage Drop

Voltage drop through the filter at operation frequency shall not exceed 2 percent of the rated line voltage when the filter is fully loaded with a resistive load (unity power factor). Voltage drop measurements shall be in accordance with paragraph Voltage Drop Measurements.

#### 2.7.2.4 Input Elements

Filters shall be provided with inductive inputs. If inductive input is used an ESA is required to protect the filter. The inductor shall ensure firing potential for the preceding ESA and shall limit the current through the filter capacitor. The input inductor shall be designed to withstand at least a 10,000-volt transient.

#### 2.7.2.5 Drainage of Stored Charge

Filters shall be provided with bleeder resistors to drain the stored charge from the capacitors when power is shut off. Drainage of stored charge shall be in accordance with [NFPA 70](#).

#### 2.7.2.6 Insertion Loss

Insertion loss shall meet or exceed the levels complying with EM shielding effectiveness attenuation requirements herein when measured in accordance with [MIL-STD-220](#). Insertion loss measurements shall be performed in accordance with [MIL-STD-220](#) and the paragraph ELECTROMAGNETIC FILTERS.

#### 2.7.2.7 Operating Temperature Range

Individual filters mounted in the filter enclosure operating at full load amperage and rated voltage shall not exceed plus 185 degrees F based on an ambient temperature of 150 degrees F outside the filter enclosure. Continuous operation from minus 67 to plus 185 degrees F shall be demonstrated according to paragraph "Filter Life Test (at Elevated Ambient Temperature)". Filters shall also withstand temperature cycling as specified in paragraph ELECTROMAGNETIC FILTERS. The filter shall remain at rated voltage and full-load current until temperature equilibrium is reached or 24 hours, whichever is greater.

#### 2.7.2.8 Current Overload Capability

Filters shall be capable of operating at 140 percent of rated current for 15 minutes, 200 percent of rated current for 1 minute, and 500 percent of rated current for 1 second when tested in accordance with paragraph Overload Test.

#### 2.7.2.9 Reactive Shunt Current

The reactive shunt current drawn by the filter operating at rated voltage shall not exceed 30 percent of the rated full-load current when measured in accordance with paragraph Reactive Shunt Current Measurements.

#### 2.7.2.10 Dielectric Withstand Voltage

Filters shall be provided which conform to the minimum values of dielectric withstanding voltage. Filter dielectric withstand voltage test shall be in accordance with paragraph "Dielectric Withstand Voltage Test". HEMP filters shall be capable of operating continuously at full-rated voltage and of withstanding an overvoltage test of 2.8 times the rated voltage for 1 minute. In addition, each filter shall be capable of withstanding a 20-kV or 4-kA peak transient pulse of approximately 20 ns pulse width at full operating voltage, without damage.

#### 2.7.2.11 Insulation Resistance

The insulation resistance between each filter terminal and ground shall be greater than 1 megohm when tested in accordance with paragraph Insulation Resistance Test.

#### 2.7.2.12 Parallel Filters (Current Sharing)

Where two or more individual filters are electrically tied in parallel to form a larger filter, they shall equally share the current. Equally sharing is defined to be within 5 percent of the average current. The tests shall be in accordance with paragraph ELECTROMAGNETIC FILTERS.

#### 2.7.2.13 Harmonic Distortion

Harmonics generated by the insertion of a filter shall not increase line voltage distortion more than 2.5 percent when measured with a unity power factor in accordance with the paragraph ELECTROMAGNETIC FILTERS.

#### 2.7.3 Marking of Filter Units

Each filter case shall be marked with HCI tags and with the rated current, rated voltage, manufacturer s name, type of impregnating or potting compound, operating frequency, and model number. In addition, individual filter cases, the filter enclosures, and supply and load panelboards of filtered circuits shall be marked by the manufacturer with the following: "WARNING: Before working on filters, terminals shall be temporarily grounded to ensure discharge of capacitors. Nameplates and warning labels shall be securely attached.

#### 2.7.4 Minimum Life

Filter assemblies shall be designed for a minimum service life of 15 years. Submit filter schedule including voltage, amperage, enclosure type (low, high, band pass), location, cut-off frequency, band pass frequencies, and electrical surge arresters (ESA). Submit data and/or calculations for design of EM door including schedule of EM penetrations.

### 2.7.5 Power and Signal Line Factory Testing

Factory test report data shall be submitted for each filter configuration, voltage, and amperage which shall show the ability of filters to meet the specified requirements. Filter test reports shall be based on prior tests of the same filter assembly design and components. Test data reports shall be submitted in accordance with paragraph SUBMITTALS. Test data shall include the following:

- a. Voltage Drop Measurements.
- b. Insertion Loss Measurements.
- c. Filter Life Test.
- d. Thermal Shock Test.
- e. Overload Test.
- f. Reactive Shunt Current Measurements.
- g. Dielectric Withstand Voltage.
- h. Insulation Resistance Test.
- i. Current Sharing.
- j. Harmonic Distortion.
- k. Terminals.

#### 2.7.5.1 Voltage Drop Measurements

The voltage drop measurements on both ac and dc filters shall be performed with the components mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method that will be used for mounting in the enclosure. For ac rated filters, measurements shall be made by using expanded scale-type meters. For dc rated filters, measurements shall be made by using a dc meter when the filter is carrying rated current and rated voltage.

#### 2.7.5.2 Insertion Loss Measurements

Insertion loss measurements for power filters shall have the following modifications. The filters shall be installed in the filter/ESA assembly enclosure. The load current power supply shall operate at the rated voltage of the filters and shall be capable of providing any current from no-load through rated full-load current. The rf signal generator shall be a swept continuous wave (cw) source. The buffer networks shall be modified to permit valid measurements over the entire frequency band on which insertion loss requirements are specified (14 kHz-1 Ghz). The receiver or network analyzer shall be capable of operating over the entire frequency band on which insertion loss requirements are specified (14 kHz-1 Ghz). Sensitivity shall be adequate to provide a measurement dynamic range at least 10 dB greater than the insertion loss requirement. The load impedance shall be resistive and shall be capable of dissipating the rated full-load filter current. Insertion loss measurements shall be made at 20 percent, 50 percent, and 100 percent of the filter full-load operating

current. Insertion loss measurements for communication/signal line filters shall be performed the same as for power filters except that the insertion loss measurements are required at a load impedance equal to the image impedance of the filter. No load insertion loss measurements shall be performed over the frequencies defined in the EM shielding effectiveness attenuation requirements for both power and communication filters.

[Testing shall be load to source for TEMPEST.] [Testing shall be source to load for HEMP.]

#### 2.7.5.3 Filter Life at High Ambient Temperature

This test is conducted for the purpose of determining the effects on electrical and mechanical characteristics of a filter, resulting from exposure of the filter to a high ambient temperature for a specified length of time, while the filter is performing its operational function. Surge current, total resistance, dielectric strength, insulation resistance, and capacitance are types of measurements that would show the deleterious effects due to exposure to elevated ambient temperatures. A suitable test chamber shall be used which will maintain the temperature at the required test temperature and tolerance. Temperature measurements shall be made within a specified number of unobstructed inches from any one filter or group of like filters under test. This test shall be made in still air. Specimens shall be mounted by their normal mounting means. When groups of filters are to be tested simultaneously, the mounting distance between filters shall be as specified for the individual groups otherwise the mounting distance shall be sufficient to minimize the temperature on one filter affecting the temperature of another. Filters fabricated of different materials shall not be tested simultaneously. The test temperature shall be  $184 + 34$  degrees F. The length of the test shall be for 5,000 hours. Specified measurements shall be made prior to, during, or after exposure.

#### 2.7.5.4 Thermal Shock Test

This test is conducted for the purpose of determining the resistance of a filter to exposures at extremes of high and low temperatures, and to the shock of alternate exposures to these extremes. Suitable temperature controlled systems shall be used to meet the temperature requirements and test conditions. Environmental chambers shall be used to meet test requirements and to reach specified temperature conditions. Filters shall be placed so that there is no obstruction to the flow of air across and around the filter. The filter shall be subjected to the specified test condition. The first five cycles shall be run continuously. After five cycles, the test may be interrupted after the completion of any full cycle, and the filter allowed to return to room ambient temperature before testing is resumed. One cycle consists of steps 1 through 4 of the applicable test condition for dual environmental test chambers (one low temperature and one high temperature test chamber) and steps 1 and 3 for single compartment test chambers where both high and low temperatures are achieved without moving the filter. The test conditions are as follows:

1. -55 deg C. 0 deg and -3 deg
2. 25 deg C. +10 deg and -5 deg
3. 85 deg C. + 3 deg and -0 deg
4. 25 deg C. +10 deg and -5 deg

The effective total transfer time from the specified low temperature to the specified high temperature shall not exceed 5 minutes. The exposure time in air at the extreme temperatures is a function of the weight of the



filter. The minimum exposure time per the weight of the filter shall be as follows:

1 oz. and below	15 minutes
Above 1 oz. to 4.8 oz.	30 minutes
Above 4.8 oz. to 3 lb.	1 hour
Above 3 lb. to 30 lb.	2 hours
Above 30 lb. to 300 lb.	4 hours
Above 300 lb.	8 hours

Specified measurements shall be made prior to the first cycle and upon completion of the final cycle, except that failures shall be based on measurements made after the specimen has stabilized at room temperature following the final cycle.

#### 2.7.5.5 Overload Test

Filters shall be mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method that will be used for mounting in the enclosure. A specified current shall then be applied for a specified period of time. After the filter has returned to room temperature, the insulation resistance and voltage drop shall be measured. The insulation resistance shall be measured using the method in paragraph ELECTROMAGNETIC FILTERS. AC voltage drop measurements shall be made by using expanded scale-type meters which will enable voltage differences of less than 1 volt to be read. DC voltage drop measurements shall be made by using a dc reading meter when the filter is carrying rated current and rated voltage. The insulation resistance and the voltage drop will be measured after each separate overload test. Filters will also be visually examined for evidence of physical damage after each test.

#### 2.7.5.6 Reactive Shunt Current Measurements

The reactive shunt current measurements shall be performed with the filters mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method that will be used for mounting in the enclosure. The filter shall be terminated in the inner compartment in an open circuit. Rated ac voltage shall be applied between the filter outer compartment terminal and the enclosure or metal plate. The ac current into the outer compartment terminal shall be monitored. The measured current is equal to the filter reactive shunt current.

#### 2.7.5.7 Dielectric Withstand Voltage Test

The dielectric withstanding voltage test (also called high-potential, over potential, .voltage breakdown, or dielectric-strength test) consists of the application of a voltage higher than rated voltage for a specific time between mutually insulated portions of a filter or between insulated portions and ground. Repeated application of the test voltage on the same filter is not recommended as even an overpotential less than the breakdown voltage may injure the insulation. When subsequent application of the test potential is specified in the test routine, succeeding tests shall be made

at reduced potential. When an alternating potential (ac) is used, the test voltage shall be 60 Hz. and shall approximate a true sine wave in form. All ac potentials shall be expressed as root-mean-square values. The KVA rating and impedance of the source shall permit operation at all testing loads without serious distortion of the waveform and without serious change in voltage for any setting. When a direct potential (dc) is used, the ripple content shall not exceed 5 percent rms of the test potential. A voltmeter shall be used to measure the applied voltage to an accuracy of 5 percent. When a transformer is used as a high-voltage source of ac, a voltmeter shall be connected across the primary side or across a tertiary winding provided that the actual voltage across the filter will be within the allowable tolerance under any normal load condition. Unless otherwise specified, the test voltage shall be dc and shall be as follows:

DC rated only	2.5 times rated voltage
For filters with ac and dc ratings	2.5 times rated dc voltage
AC rated only	4.2 times rated rms voltage

The duration of the dc test voltages shall be 5 seconds minimum, 1 minute maximum, after the filter has reached thermal stability at maximum operating temperature produced by passage of rated current. The test voltage shall be applied between the case (ground) and all live (not grounded) terminals of the same circuit connected together. The test voltage shall be raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts (rms or dc) per second. Upon completion of the test, the test voltage shall be gradually reduced to avoid voltage surges. The changing current shall be 50 mA maximum. During the dielectric withstanding voltage test, the fault indicator shall be monitored for evidence of disruptive discharge and leakage current. The sensitivity of the breakdown test equipment shall be sufficient to indicate breakdown when at least 0.5 mA of leakage current flows through the filter under test. The test shall be performed with the components mounted in the filter/ESA assembly enclosure. Filters for ac circuits shall be tested with an ac source while filters for dc circuits shall be tested with a dc source. After the test the filter shall be examined and measurements shall be performed to include insulation resistance measurements to determine the effect of the dielectric withstanding voltage test on specific operating characteristics.

#### 2.7.5.8 Insulation Resistance Test

This is a test to measure the resistance offered by the insulating members of a filter to an impressed direct voltage tending to produce a leakage current through or on the surface of these filters. Insulation-resistance measurements shall be made on an apparatus suitable for the characteristics of the filter to be measured such as a megohm bridge, megohm-meter, insulation-resistance test set, or other suitable apparatus. The test shall be performed with the components mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method that will be used for mounting in the enclosure. The bleeder resistor shall be disconnected. The direct potential applied to the specimen shall be the largest test condition voltage (100, 500, or 1,000 volts +10 percent) that does not exceed the rated peak ac voltage or the rated dc voltage. A separate dc power supply may be used to charge the filters to the test voltage. The measurement error at the insulation-resistance value required

shall not exceed 10 percent. Proper guarding techniques shall be used to prevent erroneous readings due to leakage along undesired paths. Insulation-resistance measurements shall be made between the mutually insulated points or between insulated points and ground. The insulation resistance value shall be read with a megohmmeter and recorded after the reading has stabilized. When more than one measurement is specified, subsequent measurements of insulation resistance shall be made using the same polarity as the initial measurements.

#### 2.7.5.9 Current Sharing

Testing shall be performed with the filters mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method that will be used for mounting in the enclosure. The filter inner compartment terminals shall be loaded with a resistor equal in value to the rated operating voltage divided by the sum of the current ratings of the devices in parallel. The resistor shall be capable of dissipating the total current. Rated operating voltage shall be applied at the filter outer compartment terminals. The current into each filter outer compartment terminal shall be monitored.

#### 2.7.5.10 Harmonic Distortion Test

Harmonic distortion measurements shall be made using a spectrum analyzer having a dynamic range of [70 dB] [\_\_\_\_\_] and a frequency range from [10 kHz to 1.7 GHz] [\_\_\_\_\_]. Total harmonic distortion shall be measured at the input and output terminals of the filter when operating at 25, 50, and 100 percent of rated full-load current.

#### 2.7.5.11 Terminals Pull Test

The purpose of this test is to determine whether the design of the filter terminals can withstand the mechanical stresses to which they will be subjected during installation or disassembly in equipment. Testing shall be performed with the components mounted in the filter/ESA assembly enclosure or mounted on a plate by the same holding method that will be used for mounting in the enclosure. The force applied to the terminal shall be 20 pounds. The point of application of the force and the force applied shall be in the direction of the axes of the terminations. The force shall be applied gradually to the terminal and then maintained for a period of 5 to 10 seconds. The terminals shall be checked before and after the pull test for poor workmanship, faulty designs, inadequate methods of attaching of the terminals to the body of the part, broken seals, cracking of the materials surrounding the terminals, and the changes in electrical characteristics such as shorted or interrupted circuits. Measurements are to be made before and after the test.

### 2.8 ELECTRICAL SURGE ARRESTERS (ESA)

#### 2.8.1 Power and Signal Line ESA

##### 2.8.1.1 ESA General

ESAs shall be metal oxide varistors (MOVs) or spark gaps. When a spark gap is specified, the ESA shall be enclosed within a metal case. Discharges shall be contained within the case; no external corona or arcing will be permitted. ESAs shall be factory installed with minimum lead lengths within the outer compartment. For all power filter/ESA assemblies, the ESAs shall be installed a minimum of 3 inch apart, with terminals at least 3

inch from a grounded surface. For telephone filter/ESA assemblies, the ESAs shall have a minimum clearance spacing of 1 inch, and terminals shall be at least 3 inch from a grounded surface. Each phase, neutral and telephone circuit conductor shall be connected through an ESA to the ground bus. The ESA shall be installed [in the power input compartment of the filter] [in a separate EM shielded enclosure]. ESA units within the filter/ESA assembly shall be individually replaceable. Like ESAs shall be interchangeable. ESA terminals shall withstand the 20 lb pull test. Live parts shall be spaced in accordance with NFPA 70. ESA leads shall be copper. Individual ESAs shall be marked with HCI tags and shall be marked with the manufacturer's name or trademark and part number. The ESA shall meet the requirements of IEEE C62.11, IEEE C62.41.1, IEEE C62.41.2, and UL 1449.

#### 2.8.1.2 Wiring

The ESAs shall be located so that leads of minimum length connect the ESA ground terminal to the enclosure. The total lead length connecting the ESA to the filter and the ESA ground terminal to the enclosure shall be less than 12 inch. Power line ESA wiring shall be No. 4 AWG minimum. Communication/signal line ESA wiring shall be of the same or heavier gauge than the communication/signal line conductor.

#### 2.8.1.3 Voltage Characteristics

Measurements of (MOV) voltage at 1 mA dc current and spark gap dc breakdown voltage shall be made in accordance with the following procedure. Testing shall be performed with the ESAs mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. A variable dc power supply shall be connected between the ESA terminal and the enclosure (or plate). The applied dc voltage shall be increased at a rate not to exceed 10 percent of the rated firing voltage per second. The (MOV) voltage at 1 mA dc current is the power supply output voltage, when the output current is 1 milliamperere. The spark gap dc breakdown voltage is the applied voltage just prior to breakdown (indicated by a rapid decrease in the voltage across the device). The power supply shall be de-energize immediately after the value has been recorded. MOV direct current breakdown voltage at 1 milliamperere dc current shall be at least [340] [500] [1,000] [\_\_\_\_\_] volts and less than [425] [1,500] [\_\_\_\_\_] volts. MOV testing shall be in accordance with IEEE C62.33. Spark gap direct current breakdown (sparkover) voltage shall be at least [500] [1,000] [\_\_\_\_\_] volts and less than [1,500] [3,000] [\_\_\_\_\_] volts. Spark gap impulse sparkover voltage of the ESA shall be less than 4,000 volts. This voltage shall be on surges of either polarity having a rate of rise of 1,000 volts/nanosecond. Testing of the ESA impulse sparkover voltage shall be performed with the spark gaps mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. The pulse generator shall be connected between the spark gap terminal and the enclosure (or plate) with a minimum inductance connection. The pulse generator shall be capable of providing a ramp voltage of 1 kV/ns to a peak voltage which is at least twice the open circuit impulse sparkover voltage. Voltage across the spark gap shall be monitored on an oscilloscope or transient digitizing recorder, capable of at least 1 ns resolution. The peak transient voltage during the pulse is the impulse sparkover voltage. Response time shall be less than 4 nanoseconds. Clamping voltage of the ESA shall be less than [900] [\_\_\_\_\_] volts at a current pulse of 10 kA. ESA clamping voltage measurements shall be performed with the ESAs mounted in the filter/ESA assembly enclosure or

mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. The pulse generator shall be connected between the ESA terminal and the enclosure (or plate) with a minimum inductance connection. The pulse generator shall be capable of providing a 10 kA current pulse, on an 8- by 20-microsecond waveshape into the ESA. Current through the ESA and voltage across the ESA shall be monitored on oscilloscopes or transient digitizing recorders. The asymptotic voltage during the 10 kA portion of the pulse is the clamping voltage.

#### 2.8.1.4 ESA Extinguishing Characteristics

The ESA shall extinguish and be self-restoring to the normal nonconductive state within one-half cycle at the operating frequency. The [ESA extinguishing test](#) shall be performed with the ESA mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. The extinguishing test shall use an ac power source connected between the ESA terminal and ground which shall be at the rated voltage and frequency capable of providing at least 25 amperes into a short-circuit load. A pulse generator capable of providing a short pulse which will fire the ESA shall also be connected across the ESA. Voltage across the ESA shall be monitored on an oscilloscope or transient digitizing recorder. A series of ten pulses shall be injected. Performance of the ESA is satisfactory if the arc extinguishes (indicated by re-occurrence of the sinusoidal waveform) within 8.5 milliseconds after the start of each pulse.

#### 2.8.1.5 ESA Extreme Duty Discharge Current

The ESA shall be rated to survive the extreme duty discharge current of a single 8- x 20-microsecond pulse with a 10 to 90 percent rise time of 8 microseconds and fall time to a value of 36.8 percent of peak in 20 microseconds. The ESA for high voltage power lines (above 600 volts) shall have an extreme duty discharge capability equal to or greater than 70 kA. The ESA for low voltage power lines (below 600 volts) to such things as building interiors, area lighting, and external HVAC equipment shall have an extreme duty discharge capability equal to or greater than 50 kA. The ESAs for control circuits such as interior alarms, indicator lights, door access controllers, HVAC controls, and telephones, shall have an extreme duty discharge capability equal to or greater than 10 kA. The [ESA extreme duty discharge test](#) shall be performed with the ESA mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. A pulse generator shall be connected between the ESA terminal and the enclosure (or plate) with a minimum inductance connection. The pulse generator shall be capable of supplying an 8- x 20-microsecond waveshape and a only single pulse is required. Current through the ESA and voltage across the ESA shall be monitored on oscilloscopes or transient digitizing recorders. The ESA shall be visually monitored during the test and after the pulse inspected for charring, cracks, or other signs of degradation or damage. Test shall be on a prototype only. The dc breakdown voltage test shall be repeated.

#### 2.8.1.6 Minimum Operating Life

The ESA operating life tests shall be performed with the ESA mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. A pulse generator shall be connected between the ESA terminal and the enclosure (or plate) with a minimum inductance connection. The pulse generator shall be

capable of supplying repetitive 4 kA current pulses, with a 50 ns x 500 ns waveshape, to the ESA. A series of ten pulses is required. Current through the ESA and voltage across the ESA shall be monitored on oscilloscopes or transient digitizing recorders. The ESA shall be visually monitored during the series of pulses for indications of external breakdown. The ESA shall be able to conduct 2,000 pulses at a peak current of 4 kA and 50 nanoseconds x 500 nanoseconds waveform. Post-test shall include inspection for charring, cracks, or signs of degradation. The dc breakdown voltage test shall be repeated.

#### 2.8.1.7 Operating Temperature

The ESA shall be rated for continuous operation in ambient temperatures from minus 12 to plus 255 degrees F.

#### 2.8.2 ESA Testing

ESA factory test data shall be submitted which shall show the ability to meet the requirements herein, based on prior tests of the same ESA assembly components and design. Testing shall be performed with the ESA mounted in the filter/ESA assembly enclosure or mounted on a metal plate by the same holding method which will be used for mounting in the enclosure. The pulse generator shall be connected between the ESA terminal and the enclosure (or plate) with a minimum inductance connection. Current through the ESA and voltage across the ESA shall be monitored on oscilloscopes or transient digitizing recorders. Test data shall include the following:

- a. Breakdown Voltage.
- b. Impulse Sparkover Voltage.
- c. Clamping Voltage.
- d. Extinguishing.
- e. Extreme Duty Discharge.
- f. Surge Life.

#### 2.9 WAVEGUIDE ASSEMBLIES

Waveguide-below-cutoff (WBC) protection shall be provided for all piping, ventilation, fiber optic cable penetrations and microwave communications barrier penetrations of the HEMP electromagnetic barrier. These WBC penetrations shall be protected with cutoff frequencies and attenuation no less than the EM shielding effectiveness values listed herein. The cutoff frequencies shall be no less than 1.5 times the highest frequency of the shielding effectiveness. For 1 GHz, the maximum rectangular linear diagonal dimension shall be 4 inch and the maximum circular diameter shall be 4 inch. The length-to-cell cross-section dimension ratio of the waveguide shall be a minimum of [5:1 to attain 100 dB] [3:1 to attain 50 dB]. Penetration locations shall be arranged to facilitate installation and testing by minimizing the number of locations. Waveguides of each assembly type shall be factory tested in accordance with IEEE 299 and Table I of this specification.

##### 2.9.1 Waveguide-Type Air Vents

Each ventilation WBC array shall be a honeycomb-type air vent with a core

fabricated of corrosion resistant steel as shown on the drawings. Waveguide construction shall include heavy frames to dissipate the heat of welding to the shield. A welded WBC array shall be constructed from sheet metal or square tubes. Array cells shall be formed by welding the sheets at intersections or welding adjacent tubes along the entire length of the WBC section. The maximum cell size shall be 4 inch on a diagonal. The length of the WBC section shall be at least five times the diagonal dimension of the cells. Air vents shall be a permanent part of the shielded enclosure and shall have a shielding effectiveness equal to that of the total enclosure. Static pressure drop through the vents shall not exceed 0.01 inch of water at an air velocity of 1000 fpm. Waveguides for air vents (honeycomb) shall have access doors in duct work for maintenance. The frame of the honeycomb panel shall be [welded] [bolted] into the penetration plate [with continuous circumferential EM welds.] [with bolts 3 inch on center.] Welds for fabrication and installation of honeycomb waveguide panels are primary shield welds and shall be inspected as indicated. Acceptance testing of all honeycomb panels shall be included with the final acceptance test. Conductors, such as wires and louver operating rods, shall not pass through the waveguide openings.

#### 2.9.2 Piping Penetrations

All piping penetrations of the HEMP barrier to include utility piping, fire mains, vent pipes, and generator and boiler exhausts shall be made with piping WBC sections. The WBC material shall be steel with a composition suitable for welding to the HEMP shield. The minimum wall thickness shall be 0.125 inch. The maximum inside diameter shall be 4 inch or a metallic honeycomb insert with a maximum cell dimension of 4 inch shall be installed. The WBC section shall have an unbroken length of at least five diameters to form a minimum cutoff frequency of 1.5 times the highest frequency of the shield effectiveness. The piping WBC section shall be circumferentially welded or brazed to the HEMP shield, pipe sleeve or a penetration plate as shown on the drawings. Generator and boiler exhausts shall be constructed as shown in the drawings and shall be configured as a WBC or WBC array. The circumferential penetration welds are primary shield welds and shall be inspected and tested as indicated.

#### 2.9.3 Waveguide Penetrations

Waveguide penetrations for dielectric fibers or hoses shall be implemented in the same manner as piping penetrations. Dielectric hoses or pipes shall be converted to metal waveguide piping before penetrating the shield. Conductors, such as wires and fiber cable strength members, shall not pass through the waveguide opening.

#### 2.9.4 GROUNDING STUD

Enclosure shall have 1/2 inch diameter stud circumferentially welded to each side of the shielding penetration plate.

#### 2.10 PENETRATION PLATES

Penetration plates shall be minimum 1/4 inch thick and sized as shown on the drawings. The penetration plate shall overlap the shield penetration cutout dimension by a minimum of 6 inch on each side. The penetration plate shall be [welded] [bolted] to the HEMP shield [with continuous circumferential EM welds.] [with bolts 3 inch on center.]

#### 2.11 GALVANIZING

Galvanizing, when practical and not otherwise indicated, shall be hot-dipped processed after fabrication. Galvanizing shall be in accordance with [ASTM A123/A123M](#), or [ASTM A653/A653M](#), as applicable. Exposed fastenings shall be galvanically compatible material. Electrolytic couples and dissimilar metals that tend to seize or gall shall be avoided.

## 2.12 EM SHIELDED CABINETS AND PULL BOXES

Cabinets and pull boxes shall be modified NEMA [1] [\_\_\_\_\_] in accordance with [NEMA ICS 6](#) made of corrosion resistant steel of not less than 14 gauge thick with welded seams and galvanized bulkhead cover plates. Access cover plates shall be hinged with EM gaskets and 3 inch maximum bolt spacing. Design shall include thick cover plates, folded enclosure edges, and bolt spacers to prevent uneven gasket compression and enclosure deformation. Gasket shall be easy to replace. Gasket contact areas shall be tin-plated using the electrodeposited type I method in accordance with [ASTM B545](#). Conduit hub shall be circumferentially EM welded to the enclosure. The cabinets shall be finished with a corrosion-inhibiting primer and two coats of baked or finish enamel. Cabinets shall be provided with mounting brackets for wall mounting or legs for floor mounting. Cabinets and boxes of each type shall be factory tested in accordance with [IEEE 299](#) and Table I of this specification.

## 2.13 QUALITATIVE MONITORING SYSTEM

A built-in shield monitoring system for SELDS testing shall be provided. The system shall consist of either multiple injection points or a surface loop system. Driving conductors shall be brought to a single lockable EM shielded connection box, located outside the shield in a controlled space.

## PART 3 EXECUTION

### 3.1 EXAMINATION

After becoming familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

### 3.2 INSTALLATION

#### 3.2.1 Coordination

The EM shielding installer shall instruct other trades in the presence and with the direction of the Government representative, in advance of the [EM shielding system](#) installation, to ensure that all individuals are aware of the critical installation requirements. Submit manufacturer's data, catalog cuts, and printed documentation regarding the work. Cleaners, solvents, coatings, finishes, physical barriers, and door threshold protectors shall be provided as required to protect the shielding system from corrosion, damage, and degradation. The shielding installation plan shall be approved before construction begins.

#### 3.2.2 Verification

Before, during, and after the EM shielding and penetration protection subsystem installation, the shielding specialist shall verify and approve the installation for compliance with the specifications. Materials and methods, shop drawings, and other items for the shielding subsystem shall



bear an approval stamp of the shielding specialist. Compliance notification shall be provided to the Contracting Officer before materials are installed or methods performed.

### 3.2.3 Inspection

During and after EM shielding and penetration protection subsystem installation, including EM filters and waveguides, a qualified shielding specialist shall inspect the installation for compliance with the specifications. Complete the inspection before a finish or concrete topping coat is installed.

### 3.2.4 Manufacturer's Services

Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

### 3.2.5 Posting Framed Instructions

Post framed instructions containing wiring and control diagrams under glass or in laminated plastic. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams before acceptance testing of the system.

## 3.3 ENCLOSURE INSTALLATION - WELDED STEEL CONSTRUCTION

Install the EM shielded enclosure in accordance with this specification, the drawings, and the recommendations of the manufacturer and EM shielding specialist. Handle and install shielding steel without damage. Penetrations of the shield, other than those indicated on the drawings, will not be permitted, including fasteners and mounting bolts, without prior written authorization from the Contracting Officer.

### 3.3.1 Surface Preparation

Clean and buff contacting surfaces to ensure firm contact with shielding steel.

### 3.3.2 Control of Warping

Keep warping of steel shielding plates during installation and welding within 1/8 inch in 10 feet. Use embeds, drive pins, and/or anchor bolts or ties to hold plates in place during welding. Other techniques such as skip welding shall also be used to reduce warpage. The system chosen shall be fully coordinated and approved by the Contracting Officer. Fasteners, drive pins, and other shield penetrations shall be sealed with full penetration circumferential EM welds.

### 3.3.3 Placement of Floor Shield

Placement of the floor shield shall not begin until at least 14 days after the pouring of the floor slab and Contracting Officer approval of all required submittals. [The placement of the floor shield shall utilize [the shingle overlap method] [\_\_\_\_\_].] [Individual floor sheet shall be attached on the top and one side only with air-pressure drive tools to the floor. Floor shielding sheets shall be overlapped 2 inch at joints, bent and laid flat on the concrete floor without voids or gaps, and sealed with

continuous EM welds at all seams and joints.] The floor shield installation shall start at the center of the space.

#### 3.3.4 Placement of Overslab

Before placement of the overslab over any portion of the floor shield, the Contracting Officer's approval is required. Both visual and SELDS testing of the shielding within the area to be covered shall be successfully completed, any defects repaired and retested, and full test results supplied to the Contracting Officer prior to placement of the overslab. A vapor barrier shall be placed over the floor shield.

#### 3.3.5 Welding

The shielding work shall be provided in accordance with the performance criteria specified. Shielding steel structurally welded to the steel frame shall be welded in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M. EM shielding seams shall be sealed EM-tight by the MIG method, using electrodes structurally and electrically compatible with the adjacent steel sheets. [Sheet steel shall be welded to support steel by plug or tack welding at 12 inch on center, and then sheet seams shall be continuously EM welded to seal the enclosure] [\_\_\_\_\_]. Slag inclusions, gas pockets, voids, or incomplete fusion will not be allowed anywhere along welded seams. Weld failures shall be corrected by grinding out such welds and replacing with new welds. A qualified welder shall perform welding, both structural and EM sealing. Weldments critical to shielding effectiveness are shown on the drawings and shall be performed in the manner shown on the drawings. Where both structural integrity and shielding quality are required for a given weldment, both criteria shall be met simultaneously. Brazing shall conform to the documents discussed above, where practical, and shall also conform to requirement of AWS BRH. Structural, mechanical, or electrical systems penetrations shall be sealed by providing a continuous solid perimeter weld, or braze to the shield as specified. All shield joints and seams shall have a minimum 2 inch overlap and shall be sealed with a continuous solid weld. After testing, the Contracting Officer will inspect and approve the installation prior to covering by other trades.

#### 3.3.6 Wall Shielding Attachment

Continuous [16] [\_\_\_\_\_] gauge thick furring channels spaced not more than 24 inch on center shall be secured to steel wall studs by using self-tapping sheet metal screws. The steel sheets shall be tack welded to the furring strips every 16 inch on center horizontally and 24 inch on center vertically. A continuous full penetration EM weld shall be made to join the sheets and form the shield. Welds shall not form dimples or depressions causing fish mouths at the edge of the sheet.

#### 3.3.7 Formed Closures

Install formed closures where indicated and/or necessary to completely close all joints, openings, enclosures of pipe chases, and structural penetrations, columns, and beams.

#### 3.3.8 Sequence of Installation

Erection of the steel shall be sequenced to prevent steel sheet warpage. Install shielding components that have passed initial testing (part 1) before construction of any features that would limit access for repairs to

the shield.

### 3.3.9 Door Assemblies

Mount doors to perform as specified. Door framing shall be continuously welded to the EM shield. The structural system supporting the door frame shall provide proper support for doors and frame.

## 3.4 ENCLOSURE INSTALLATION - BOLTED CONSTRUCTION

### 3.4.1 Enclosure Panel Installation

Install panels, without damage to the shielding steel, in accordance with the shielding manufacturer's recommendations. Exposed surfaces shall be cleaned of dirt, finger marks, and foreign matter resulting from manufacturing processes, handling, and installation. Install electrical conduits as close to the EM shield as possible. Framing-joining system bolts shall not be used to mount material and equipment. Material and equipment which penetrate the shielded enclosure shall be seam welded or soldered to both shielding surfaces.

### 3.4.2 Surface Preparation

Clean and buff surfaces to ensure good electrical contact with shielding surface. Paint or other coverings on mating surfaces of special boxes such as for fire alarm systems, buzzers, and signal lights, including areas between box and cover, box and wall, and box and conduit, shall be removed. Remove insulating material to maintain a low-resistance ground system and to ensure firm mating of metal surfaces.

### 3.4.3 Floor Panel Setting

Place a polyethylene film 6 mil thick vapor barrier over the structural floor of the parent room before any other work is set thereon. Provide a 1/8 inch thick layer of hardboard over this film with joints loosely butted. Over this layer an additional layer of similar filler material of equal thickness as the projection of the framing-joining member from the bottom surface of the floor panel shall be provided leaving no more than 1/4 inch of space between the hardboard and the framing-joining member.

### 3.4.4 Framing-Joining System

Tighten screws with a calibrated adjustable torque wrench with equal torque set for each screw. Proper torque values shall be in accordance with the manufacturer's requirements.

### 3.4.5 Door Assemblies

Mount the door to perform as specified. The door shall be through-bolted to the EM shield.

### 3.4.6 Filter Installation

Support filters independently of the wall shielding. Conduct inspections on filters provided under this specification, to verify compliance with the specified requirements. Filters shall be shipped after successful testing and shall be examined prior to installation to determine if damage occurred during shipment. Damage, no matter how slight, will be reason for rejection of the filter.

### 3.5 WAVEGUIDE INSTALLATION

Penetrations of the EM shield shall be treated with the appropriate waveguide method. Waveguides shall be suitable for piping and for fluids or gases contained within, in accordance with specified requirements.

### 3.6 SHIELDING PENETRATION INSTALLATION

Penetrations shall be installed in accordance with requirements of the penetration schedule and coordinated with system installation.

### 3.7 FIELD QUALITY CONTROL

Develop a [quality control plan](#) to ensure compliance with contract requirements; maintain quality control records for construction operations required under this section; and submit the quality control plan to the Contracting Officer. Furnish a copy of testing records, as well as the records of corrective actions taken. The in-progress and final acceptance testing of EM shielding and penetration protection system work shall be performed as specified. Correct deficiencies at no additional cost to the Government. Legible copies of the daily inspection reports shall be maintained by the shielding specialist at the project site, and the copies of the Construction Quality Control Report shall be delivered to the Contracting Officer on the third workday following the date of the report. The daily inspections shall include the type of work being performed during the report period and locations, type of testing, deficiencies, corrective actions, unsolved problems, and recommendations to assure adequate quality control. Results of inspections and tests performed in accordance with this specification shall be attached to the daily Construction Quality Control Report.

### 3.8 FIELD TRAINING

Provide a field training course for designated operating and maintenance staff members. Training shall be provided for a total period of [8] [\_\_\_\_\_] hours of normal working time and shall start after the system is functionally complete but prior to the final acceptance test. Field training shall cover all the items contained in the Operating and Maintenance Manuals.

### 3.9 SHIELDING QUALITY CONTROL

The Contractor's organizational structure for shielding quality control shall be integrated into the jobsite management. Testing shall be performed by [an independent testing firm] [the shielding installer].

#### 3.9.1 HEMP Hardness Critical Item Schedule

Hardness critical items shall be identified during the detail drawing submittal period. These items are those components and/or construction features which singularly and collectively provide specified levels of HEMP protection, such as the EM shield, surge arresters, EM shielded doors, shield welding, electrical filters, honeycomb waveguides, and waveguides-below-cutoff.

##### 3.9.1.1 Performance Test Plan

Submit a performance test plan for Contracting Officer approval. Testing

shall be accomplished in three parts: (1) in-progress; (2) initial shielded enclosure effectiveness; and (3) final acceptance, shield enclosure effectiveness. Include in the test plan equipment listings (including calibration dates and antenna factors) and the proposed test report format. The plan shall also include specific test dates and durations during the overall construction period so that the Contracting Officer may be scheduled to observe the testing and so that repairs may be made to the shield and retests conducted. This separate testing schedule for the EM enclosure shall show the points, during construction, when it begins and ends as well as a day-by-day test schedule. The test plan shall indicate proposed dates and duration of lowest and highest frequency tests so that the Contracting Officer may be available for these final acceptance tests. A test grid shall be identified and the plan for correlation of that grid to the structure shall be provided.

#### 3.9.1.2 Test Reports

Test reports shall include the method of testing, equipment used, personnel, location of tests, and test results. Daily reports of results of each test performed on each portion of the shielding system shall be submitted to the Contracting Officer within 3 working days of the test. Location of the area tested shall be clearly identified. Leaks detected during testing shall be identified with sufficient accuracy to permit relocation for testing in accordance with test procedures. Reports of testing shall be submitted to the Contracting Officer with required certification by the testing agency representative or consultant. Three reports (in-progress test report, initial test report, and final acceptance test report) shall be submitted in accordance with the format described below.

Cover Page:

A cover page is required.

Administrative Data:

Test personnel.  
Contract number.  
Date of test.

Authentication. Contractor personnel responsible for performance of the tests and witnessing organization or representatives.

Contents:

Shielded facility description.  
Nomenclature of measurement equipment.

Serial numbers of measurement equipment. Date of last calibration of measurement equipment. Type of test performed. Measured level of reference measurements and ambient level at each frequency and test point. Measured level of attenuation in decibels at each frequency and test point. Dynamic range at each test frequency and test point. Test frequencies. Location on the shielded enclosure of each test point. Actual attenuation level at each test point.

Conclusions: This section shall include results of the tests in brief narrative form.

Number of Copies of the Report:

[Three] [\_\_\_\_\_] copies.

### 3.9.2 Field Testing

Submit reports of certified test results and results of all field and factory tests as specified and as required by the Contracting Officer. Testing shall be accomplished in the three parts described below.

#### 3.9.2.1 Testing - Part 1

Perform Part 1 as in-progress testing including inspection, visual seam inspection, and seam testing of all EM shielding materials and installation. [In-progress testing of welded shielding shall include testing the structural welds to be embedded prior to concrete placement by dye penetrant and magnetic particle testing and 100 percent testing of wall, ceiling, and floor shielding welds by the SELDS tests.] [In-progress testing of bolted construction shall include 100 percent testing of floor, wall, and ceiling shielding seams by the SELDS testing.] After successful completion of in-progress testing, including defect repairs and retest, and with prior approval of the Contracting Officer, placement of embedments covering may be made to complete the structural systems. Submit an in-progress test report.

#### 3.9.2.2 Testing - Part 2

Part 2 initial testing shall consist of inspection, visual seam inspection, seam testing, and shielded enclosure effectiveness testing after shielding and shielding penetrations are completed, but before the installation of finish materials over the shielding. Access to penetrations is required. All [seams] [welds], including shielding and penetrations not tested in part 1, shall be SELDS tested. The initial shielded enclosure effectiveness acceptance test shall consist of a MIL-STD-188-125-1 test utilizing specified test frequencies for magnetic and plane wave. Testing shall be conducted in accordance with the paragraph EM Shielding Effectiveness Testing. These tests shall be performed with the number of shield penetrations limited to those required to support the test. After successful completion of Part 2 initial testing, including defect repairs and retest, and with prior approval of the Contracting Officer, placement of any covering may be made except in areas where penetrations are located. Submit an initial test report.

#### 3.9.2.3 Testing - Part 3

Perform Part 3 final acceptance testing consisting of a visual inspection and a shielded enclosure effectiveness test of the EM shielding materials and installation. All [seams] [welds], including shielding and penetrations not tested in parts 1 and 2, shall be SELDS tested. Part 3 testing shall be performed upon completion of construction and when the building is ready for occupancy. Facilities requiring HEMP protection shall be tested for shielding effectiveness in accordance with acceptance test procedures in MIL-STD-188-125-1. Notify the Contracting Officer in writing 14 days prior to tests to permit adequate monitoring by authorized representatives. Corrective work shall be accomplished immediately upon detection that any area has failed to meet the requirements specified. Retesting shall be performed to verify that remedial work done to meet the required attenuation has been properly installed. Submit a final acceptance test report.

### 3.9.3 Weld Inspection

The weld seams shall be visually inspected by a qualified welder during the

welding operation and after welding is completed. Completed welds shall be inspected after the welds have been thoroughly cleaned by hand or power wire-brush. Welds shall be inspected with magnifiers under bright light for surface cracking, porosity, slag inclusion, excessive roughness, unfilled craters, gas pockets, undercuts, overlaps, size, and insufficient throat and concavity. Defective welds shall be ground out and replaced with sound welds.

### 3.9.4 Shielded Enclosure Leak Detection System (SELDS) Testing

The leak detection system shall use a 95- to 105-kHz oscillator and a battery operated hand-held receiver. The receiver or "sniffer" shall have a ferrite loop probe capable of sensing leaks within 1/4 inch of the probe location with a dynamic range of 140 dB. Testing shall be conducted in accordance with test equipment manufacturer's instructions. Test loops or leads shall be placed under the shield floor or into inaccessible locations prior to installation to assist in the detection of seam leaks in the floor, ceiling and walls. The loop or lead wires shall be placed between the vapor barrier and the structural slab for the floor shield with the leads brought to an accessible location. The test leads shall be insulated stranded copper conductors 5/64 to 3/32 inch diameter and bonded to the shield only at the end. Test leads shall be placed in plastic conduit for protection and shall not exceed 150 ft in length. The surface area of the shield will determine the number of test leads (drive points) that are required. Drive points shall be installed on the shielding exterior and attached to two sets of diagonally opposing corners during construction. The distance between test lead connections on a shield surface shall not be more than 66 ft. The maximum testing area shall be 4300 sf. If the shield area exceeds this requirement, additional drive points shall be provided. Bonding of the test leads to the shield is accomplished by brazing or high-temperature soldering. Test leads from the drive points shall be run to a lockable test cabinet for connection to the SELDS oscillator. If more than one test cabinet is required for a given area or building, test leads that would be common to different surface areas shall be duplicated at each test cabinet to ensure that test point parings are maintained. Record the location of the permanent test leads and shall provide this information to the Contracting Officer for permanent reference. Welds and seams shall be 100 percent tested. Seams shall be continuously probed with the test receiver set to detect abrupt changes of shielding level greater than 10 dB on the shielding unit scale. Points having a change greater than 10 dB shall be clearly marked and shall have the weld repaired to meet the specified requirement. Each repaired point shall be retested until there are no points on seams which fail the test.

### 3.9.5 EM Shielding Effectiveness Testing

Services of an EM shielding testing specialist, approved by the Contracting Officer, shall be furnished to test the shielded enclosure. The laboratory shall be equipped and staffed to perform field tests of EM shielded enclosures and shall perform these tests as a normal service. Test equipment used shall have been calibrated within the last 12 months.

#### 3.9.5.1 Test Procedure

Test procedure and equipment shall be similar to that specified in MIL-STD-188-125-1. Test frequencies are specified herein. Test points shall be as indicated in Table I. Corner points of the grid shall occur at the intersection of three planes (two-wall surfaces and ceiling or two wall surfaces and floor). Measurement data at all test points shall be

recorded, and a grid map for each surface tested shall be provided. For any test point where required attenuation is not provided, correct the discrepancy and retest. Both the results of the test failure and the successful results shall be provided. Enclosure effectiveness test for magnetic attenuation shall be performed with the antennas located directly opposite each other and separated by a distance of 2 ft plus the wall thickness. Plane wave attenuation tests shall be performed with the antennas located directly opposite each other and with the transmitting antenna placed 1 ft away from the enclosure wall and with the receiving antenna set 1 ft from the wall for stationary measurements and 2 inch to 2 ft from the wall for swept measurements. The magnetic field test and the plane wave test shall be performed using the following sequence. The calibrations shall be performed at the beginning of each test day. Then the test area shall be set up for the 100 to 400 MHz stationary measurement in on to the two required polarizations. With the transmitter off check the receiver sensitivity. Energize the transmitter, and record the fixed measurement data. Remove the receiving antenna from the test stand and perform the swept measurement at the same frequency and transmitting antenna polarization. Rotate the transmitting antenna, and perform the second 100 to 400 MHz stationary measurement. Perform the swept measurement for the second transmitting antenna polarization. Reconfigure the equipment for the 900 to 1000 MHz test frequency, and repeat the series of four measurements. To perform the swept measurement, remove the receiving antenna from the test stand and hold with a dielectric rod at least 12 inch in length. A dielectric spacer shall be attached to the sweeping antenna to assist in maintaining the 2 inch distance from the shield. A rapid sweep to locate hot spots shall be made by rotating the polarization and waving the antenna through the specified volume. The final activity of each test day shall be to repeat the calibrations and verify the consistency with the previous calibration results. Test procedures shall include a definition of all test points including but not limited to walls, door frames, accessible joints, and around filters and penetrations. Each EM door shall be tested at the locations indicated in Table I.

TABLE I - SHIELDING EFFECTIVENESS TEST POINTS	
Testing Location	Test Points Spacing
Joints between steel panels for roof, walls, and floors	Test every 10 feet (Note 1; minimum of one test point per side)
Corner seams for walls to floor, walls to roof, and wall to wall	Test every 10 feet (Note 1; minimum of one test point per corner seam)
Corners (intersection of three surfaces)	Test at all corners in Shield
Single doors	Test at each corner; at midpoint of each side longer than 5 feet; and at center
Double doors	Test each separately at same test point as single doors



TABLE I - SHIELDING EFFECTIVENESS TEST POINTS	
Testing Location	Test Points Spacing
WBC vents and panels	Test in center (on axis) for all sizes (including single); at all four corners if 12 by 12 inches or larger; and at the midpoint of each side longer than 5 feet
At treated penetrations of shield (and entry panel and backshield)	Test as close to "an-axis" as possible, or orient for maximum signal
All other shield joints, seams, or corners	Sweep all surfaces at one frequency in the range of 400 MHz to 1 GHz. Test every 10 feet max. plane wave
Doors	Door handles
EM filter enclosures	Test at each seam corner and midpoint of each side longer than 5 feet at center
EM cabinets and enclosures	Test at each seam corner and each side 5 feet on center
NOTE 1. Each point shall be swept in space 2 feet around the point.	

3.9.5.2 Test Points

Additional test points shall be measured in accordance with MIL-STD-188-125-1 for facilities requiring HEMP protection. Test points include the periphery of doors and covers, handles, latches, power filter penetrations, air vent filters, communications line filter penetrations, and points of penetration by pipes, tubes, and bolts.

3.9.5.3 Test Methodology

Antennas shall be oriented for maximum signal pickup. Each test point shall be probed for area of maximum leakage, such as around door frames, accessible joints, filters, pipes, and air ducts. Magnitude and location of maximum signal levels emanating from the enclosure shall be determined for each accessible wall at a minimum of two locations on each wall, around doors, and at penetrations and seams of the enclosure. Measurement of attenuation shall be accomplished in accordance with Table I.

3.9.5.4 Test Frequencies

Testing frequencies for shielded enclosures shall be as follows:

Magnetic field	[14 kHz,] [400 kHz,] and [10.1 MHz] [_____]
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Electric field	[200 kHz] and [16 MHz] [_____]
Plane wave	[100 MHz], [415 MHz], and [1.29] [18] [_____] [GHz]
MIL-STD-188-125-1 frequencies are as follows:	
Magnetic	[_____]
Plane wave	[_____]

3.9.6 Weld Testing

Structural welds to be embedded shall be tested in accordance with AWS D1.1/D1.1M using magnetic particle inspection or dye penetrant inspection and 100 percent of the shielding seams by the SELDS testing prior to embedment.

3.10 GROUNDING

The contract drawings indicate the extent and general arrangement of the shielded enclosure grounding system. The grounding methods shall be an equipotential grounding plane method in accordance with UL 1283, NFPA 70, NFPA 77, NFPA 780, IEEE 142, MIL-STD-188-124, and MIL-HDBK-419. For additional facility grounding requirements, see Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

-- End of Section --