AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT	1. CONTRACT ID CODE	PAGE OF PAGES
		1 | 3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE	5. PROJECT NO. (If applicable)
W9127826RA012-0002	29 APR 2026		MEF22007

6. ISSUED BY CODE		7. ADMINISTERED BY(If other than item 6) CODE	

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP code)	☒	9A. AMENDMENT OF SOLICITATION NO. W9127826RA012 9B. DATED (SEE ITEM 11) 16 MARCH 2026
	☐	10A. MODIFICATION OF CONTRACT/ORDER NO. 10B. DATED (SEE ITEM 13)

CODE	FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing items 8 and 15, and returning copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. **FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER.** If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(if required)*

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

☐	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A
☐	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO AUTHORITY OF FAR 43.103(b)
☐	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
☐	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible)

The subject solicitation for: **LRSO HARDWARE SOFTWARE DEVELOPMENT FACILITY EGLIN AIR FORCE BASE, FLORIDA**

Is modified in the following: **REFER TO THE ENCLOSED REVISED SPECIFICATIONS FOR AMENDMENT NO. 0002**

Except as provided herein, all terms and conditions of the document reference in item 9A or 10A, as Heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICE (Type or print)	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of contracting officer)	16C. DATE SIGNED

PART I - REVISIONS MADE BY ADDED AND/OR REPLACEMENT PARAGRAPHS/PAGES/SECTIONS

The items listed below are to be replaced by the corresponding added and/or revised paragraphs/pages or sections. Added and/or revised paragraphs/pages or sections are indicated by a note in bottom right-hand corner of each paragraph or page. Added sections are hereby made a part of the contract and are to be inserted in the specification in the proper numerical/alphabetical sequence.

Within the specifications, deletions from the specifications are indicated by strikethrough, e.g.: ~~deletions are marked with strikethrough~~ and additions to the specifications including revisions/substitutions are indicated in bold, italic and underlined, e.g.: ***additions are indicated thus.***

SECTION	Corresponding Added or Revised Paragraph Page, and/or Section
Volume 1	
Table of Contents	Revised Page 3 as indicated herein.
SF1442	Revised Block 13.a as indicated herein.
01 14 00	Added Paragraphs 1.2.1.3, and 1.2.1.4 as indicated herein.
01 33 00	Replaced Submittal Register
Volume 2	
Table of Contents	Revised Page 3 as indicated herein.
07 61 14.00 20	Revised Paragraph 2.6 as indicated herein.
08 51 23	Added in its entirety.
08 71 00	Revised Paragraphs 2.3.3, and 2.5 as indicated herein.
08 81 00	Added in its entirety.
13 49 20.00 10	Revised Paragraphs 1.1, 1.2, 1.3.1, 1.3.7, 1.6, 1.7.3, 2.1.1, 2.2.3, 2.3, 2.4.2, 2.5.1, 2.6, 3.2.3, and 3.8.1 as indicated herein.
Volume 3	
Table of Contents	Revised Page 3 as indicated herein.
26 20 00	Revised Paragraph 2.3 as indicated herein.
Volume 4	
Table of Contents	Revised Page 3 as indicated herein.

PART II - NOTE: Revised, replacement and added drawings are listed below. These revised, replacement and added drawings are to be inserted into the folio in the proper numerical sequence. Drawings that have been revised or replaced by this amendment shall be deleted from the folio. All drawings listed below are revised unless indicated otherwise.

Sheet Reference Number	Title
G-001	COVER SHEET
C-515	UTILITY DETAILS SHEET 1
CU101	UTILITY PLAN
A-401	ENLARGED TOILET PLAN
A-610	DOOR & WINDOW SCHEDULE
A-631	DOOR HARDWARE SCHEDULE
I-101	OVERALL INTERIOR FINISH PLAN
IG101	SIGNAGE PLAN & SCHEDULE
E-702	PANEL BOARD SCHEDULES
EP103	ELECTRICAL POWER PLAN AREA B
T-401	ENLARGED TELECOM ROOMS
T-503	TELECOMMUNICATIONS RISER DIAGRAM DETAIL
T-601	TELECOMMUNICATIONS BACKBONE RISER DIAGRAM

Encl as stated:
Revised pages of the specifications as indicated in Part I.
13 Revised drawings as indicated in Part II.

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-- End of Project Table of Contents --

SOLICITATION, OFFER AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NUMBER	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	W9127826RA012	☐ SEALED BID (IFB) INVITATION FOR BID ☒ NEGOTIATED (RFP) REQUEST FOR PROPOSAL	16 MAR 2026	1 2

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NUMBER
		MEF22007

7. ISSUED BY CODE CT	8. ADDRESS OFFER TO
U.S. ARMY ENGINEER DISTRICT, MOBILE CONTRACTING DIVISION (CESAM-CT) 100 CANAL STREET MOBILE, AL 36628-0001	SAME AS BLOCK 7

9. FOR INFORMATION CALL:	a. NAME	b. TELEPHONE NO. (*Include area code*) (*NO COLLECT CALLS*)
	Leigh Dedrick / Stephanie Scalise	(251) 441-5519 / (251) 690-2479

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (*Title, identifying no., date*):

LRSO HARDWARE SOFTWARE DEVELOPMENT FACILITY, EGLIN AIR FORCE BASE, FLORIDA

* See Section 01 00 00, Paragraph “COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK”.
**Block 13A. Offeror shall submit their proposal through PIEE.

11. The contractor shall begin performance within ___8___ calendar days and complete it within ___*___ calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. (See _____ .)

12a. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (*If "YES," indicates within how many calendar days after award in Item 12b.)*	12b. CALENDAR DAYS
☒YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

a. Sealed offers in original and ___**___ copies to perform the work required are due at the place specified in Item 8 by _1400_ (***hour***) local time ***14 MAY*** ~~30 APRIL~~ 2026 (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

b. An offer guarantee ☒ is, ☐ is not required.

c. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

d. Offers providing less than __120__ calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

REVISED BY AMENDMENT NO. W9127826RA012-0002

OFFER (*Must be fully completed by offeror*)

14. NAME AND ADDRESS OF OFFEROR (*Include ZIP Code*)	15. TELEPHONE NO. (*Include area code*)
	16. REMITTANCE ADDRESS (*Include only if different than Item 14.*)
CODE FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. (*Insert any number equal to or greater than the minimum requirement stated in Item 13d. Failure to insert any number means the offeror accepts the minimum in Item 13d.)*

AMOUNTS ▶

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS
(*The offeror acknowledges receipt of amendments to the solicitation - give number and date of each*)

AMENDMENT NUMBER										
DATE										

20a. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (*Type or print*)	20b. SIGNATURE	20c. OFFER DATE

AWARD (*To be completed by Government*)

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified) ▶	ITEM	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 3204(a) ( ) ☐ 41 U.S.C. 3304(a) ( )

26. ADMINISTERED BY CODE		27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT (*Contractor is required to sign this document and return _____ copies to issuing office.*) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.	☐ 29. AWARD (*Contractor is not required to sign this document.*) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.
30a. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (*Type or print*)	31a. NAME OF CONTRACTING OFFICER (*Type or print*)

30b. SIGNATURE	30c. DATE	31b. UNITED STATES OF AMERICA BY	31c. AWARD DATE

STANDARD FORM 1442 (REV12/2022) **BACK**

REVISED BY AMENDMENT NO. W9127826RA012-0002

SECTION 01 14 00

WORK RESTRICTIONS
11/22, CHG 1: 02/23

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 information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.

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.

Amendment 0002
****

1.2.1.3 Additional Personnel Requirements

General construction and finish work of the secure area must be performed by the U.S. firms using U.S. citizens or U.S. persons. General construction includes construction activities such as building sitework, utilities, foundations, structure, and enclosure or shell, including doors, windows and façade work. Finish Work includes construction activities such as insulation, floor, partition, and ceiling systems; cabinet work; conveyor systems; specialties; building furnishings, fixtures, and equipment; and mechanical and electrical services and equipment including those specialized for fire protection, security, communication, control, energy conservation, safety, comfort, convenience, and similar purposes.

1.2.1.4 Access to the Site

All personnel and vehicles accessing the site will be required to go through a badging/vetting process as outlined in the Construction Security Plan (CSP). This is in addition to the requirements in Section 01 00 00 for access to Eglin AFB and surrounding ranges.

****

Amendment 0002

1.2.2 Working Hours

Regular working hours will consist of an 8 1/2 hour period established by the Contracting Officer, between 7 a.m. and 3:30 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 5 calendar days 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 otherwise.

1.2.4 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, and compressed air are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
LRSO Hardware Software Development Facility

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							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		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 00 00	SD-01 Preconstruction Submittals															
			Hazard Analysis	1.9	G	RO												
			AF Form 103, Base Civil	1.20	G	RO												
			Engineering Work Clearance															
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			Contractor's Area Use Plan	1.15	G	RO												
			SD-07 Certificates															
			Asbestos and Lead Based Paint	1.28	G	RO												
			Certification Letter															
			SD-11 Closeout Submittals															
			Redlined As-Built Drawings	1.14	G	RO												
			Progress As-Built Building	1.14	G	RO												
			Information Model (BIM)															
			Final As-Built BIM	1.14	G	RO												
			As-Built Drawings	1.14	G	RO												
		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 33 00	SD-01 Preconstruction Submittals															
			Submittal Register	1.8	G													
		01 33 29	SD-05 Design Data															
			Final Design High Performance	1.5.3.2	G													
			and Sustainable Building Checklist															

REPLACED BY AMENDMENT NO. W9127826RA012-0002

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
LRSO Hardware Software Development Facility

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							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		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 33 29	Final Design Sustainability eNotebook	1.5.3.2	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 26	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.8.1	G													
			Final IAQ Management Plan	1.15	S													
			Indoor Air Quality (IAQ) Management Plan	1.15	G													
			SD-06 Test Reports															
			LHE Inspection Reports	1.12.2														
			Monthly Exposure Reports	1.5	G													
			SD-07 Certificates															
			Activity Hazard Analysis (AHA)	1.9	G													
			Certificate of Compliance	1.12.3														
			Hot Work Permit	1.13														
			Standard Lift Plan	1.12.3.2	G													
			Critical Lift Plan	1.12.3.2	G													
		01 45 00	SD-01 Preconstruction Submittals															
			Contractor Quality Control (CQC) Plan	1.5.2	G													
			SD-06 Test Reports															
			Verification Statement	1.12.3														
		01 45 35	SD-01 Preconstruction Submittals															

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		01 45 35	SIOR Letter of Acceptance	3.1.1	G														
			Project Manual	3.1.1	G														
			Project Manual	3.1.1	G														
			Contractor's Statement of	1.2	G														
			Responsibility																
			SD-06 Test Reports																
			Daily Reports	3.1.1															
			Daily Reports	3.1.3															
			Biweekly Reports	3.1.1															
			SD-07 Certificates																
			Steel Truss Plant Quality	2.1															
			Assurance Program																
			Certificate of Compliance	2.1															
			Special Inspector of Record	1.5.10	G														
			Special Inspector	1.5	G														
			SD-11 Closeout Submittals																
			Comprehensive Final Report	3.1.1	G														
			Comprehensive Final Report	3.1.3	G														
		01 50 00	SD-01 Preconstruction Submittals																
			Construction Site Plan	1.3	G														
			Traffic Control Plan	3.2.1	G														
			Haul Road Plan	2.2.1	G														
			Contractor Computer	1.6.1.4	G														
			Cybersecurity Compliance																
			Statements																

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		01 50 00	Contractor Temporary Network	1.6.6	G														
			Cybersecurity Compliance																
			Statements																
			SD-03 Product Data																
			Backflow Preventers	1.4	G														
			SD-06 Test Reports																
			Backflow Preventer Tests	3.3															
			SD-07 Certificates																
			Backflow Tester	1.4.1															
			Backflow Preventers	1.4															
		01 57 19	SD-01 Preconstruction Submittals																
			UXO Recognition Plan and	1.6	G														
			Training																
			Preconstruction Survey	1.5.1															
			Regulatory Notifications	1.5.2															
			Environmental Manager	1.5.4															
			Qualifications																
			Employee Training Records	1.5.5															
			Environmental Protection Plan	1.7	G														
			Dirt and Dust Control Plan	1.7.9.1															
			Solid Waste Management Permit	1.9															
			Stormwater Pollution Prevention	3.3.1.1	G														
			Plan																
			Stormwater Notice of Intent	3.3.1.2															
			Spill Prevention Control And	3.16.2	G														
			Countermeasure (SPCC) Plan																

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		01 57 19	SD-06 Test Reports																
			Monthly Solid Waste Disposal	1.9.1	G														
			Report																
			Inspection Reports	3.3.1.3															
			Laboratory Analysis	3.8.1.1.2															
			SD-07 Certificates																
			Employee Training Records	1.5.5	G														
			Erosion and Sediment Control	1.5.5															
			Inspector																
			SD-11 Closeout Submittals																
			Regulatory Notifications	1.5.2	G														
			Assembled Employee Training	1.5.5	G														
			Records																
			Solid Waste Management Permit	1.9	G														
			Stormwater Notice of Termination	3.3.1.4	G														
			Waste Determination	3.8.1	G														
			Documentation																
			Project Solid Waste Disposal	3.8.2.1	G														
			Documentation Report																
			Sales Documentation	3.8.2.1	G														
			Hazardous Waste/Debris	3.8.3.1	G														
			Management																
			Disposal Documentation for	3.8.3.6	G														
			Hazardous and Regulated Waste																
		01 74 19	SD-01 Preconstruction Submittals																

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		01 74 19	Construction Waste Management	1.7	G														
			Plan																
			SD-06 Test Reports																
			Quarterly Reports	1.9.2															
			Annual Report	1.9.3															
			SD-11 Closeout Submittals																
			Final Construction Waste	1.10	S														
			Diversion Report																
		01 78 00	SD-03 Product Data																
			Warranty Management Plan	1.5.1															
			Warranty Tags	1.5.5															
			Spare Parts Data	1.4															
			SD-08 Manufacturer's Instructions																
			Instructions	1.5.1															
			SD-11 Closeout Submittals																
			Certification of EPA Designated	2.1	G														
			Items																
			Certification Of USDA Designated	2.2	G														
			Items																
		01 78 23	SD-10 Operation and Maintenance																
			Data																
			Facility Data Workbook	1.4	G														
			Training Plan	3.1.1	G														
			Training Outline	3.1.3	G														
			Training Content	3.1.2	G														

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		01 78 23	Operation And Maintenance	3.2.1	G													
			Manual, Progress Submittal															
			Operation And Maintenance	3.2.2	G													
			Manual, Prefinal Submittal															
			Operation And Maintenance	3.2.3	G													
			Manual, Final Submittal															
			SD-11 Closeout Submittals															
			Training Video Recording	3.1.4	G													
			Validation of Training Completion	3.1.6	G													
			Training Plan	3.1.1	G													
			Record Drawings And Utility	1.6.6.7	G													
			Systems															
		01 91 00.15	SD-06 Test Reports															
			Completed Construction	3.6	G													
			Observation Checklists															
			Design Review Report	3.1	G													
			Interim Construction Phase	3.5	G													
			Commissioning Plan															
			Final Construction Phase	3.5	G													
			Commissioning Plan															
			Issues Log	1.11	G													
			SD-07 Certificates															
			Commissioning Firm	1.8	G													
			SD-10 Operation and Maintenance															
			Data															

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		01 91 00.15	Maintenance and Service Life Plan	3.10	G												
			Systems Manual	3.9	G												
			SD-11 Closeout Submittals														
			Final Commissioning Report	3.11	G												
			Final Commissioning Report (eNotebook)	3.11	S												
		03 30 00	SD-01 Preconstruction Submittals														
			Concrete Curing Plan	1.6.3.1													
			Quality Control Program	1.6.5	G												
			Quality Control Personnel Certifications	1.6.6	G												
			Quality Control Organizational Chart	1.6.6													
			Laboratory Accreditation	1.6.8	G												
			Cold Weather Plan	1.6.5.1	G												
			Hot Weather Plan	1.6.5.2	G												
			Maturity Method Data	3.3.11													
			SD-02 Shop Drawings														
			Reinforcing Steel	1.6.2.1	G												
			Placement Sequence and Jointing Plan	3.10.1	G												
			SD-03 Product Data														
			Joint Sealants	2.4.4													
			Joint Filler	2.4.3													
			Formwork Materials	2.1													

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		03 30 00	Cementitious Materials	2.3.1															
			Vapor Barrier	2.4.5															
			Concrete Curing Materials	2.4.1															
			Reinforcement	2.6															
			Liquid Chemical Floor Hardeners	2.4.2.1															
			and Sealers																
			Admixtures	2.3.4															
			Mechanical Reinforcing Bar	2.6.2															
			Connectors																
			Local/Regional Materials	1.8.1															
			Biodegradable Form Release	2.2.2															
			Agent																
			Pumping Concrete	1.6.3.2															
			SD-04 Samples																
			Mockup	3.3.6	G														
			SD-05 Design Data																
			Concrete Mixture Proportion	1.6.1.1	G														
			SD-06 Test Reports																
			Concrete Mixture Proportion	1.6.1.1	G														
			Fly Ash	1.6.4.1															
			Pozzolans	1.6.4.1															
			Silica Fume	1.6.4.3															
			Slag Cement	1.6.4.2															
			Aggregates	1.6.4.4															
			Compressive Strength Tests	3.12.3.3	G														

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		03 30 00	Unit Weight of Structural	3.12.3.5															
			Concrete																
			Air Content	3.12.3.4															
			Slump Tests	3.12.3.1															
			Water	2.3.2															
			SD-07 Certificates																
			Reinforcing Bars	2.6.1															
			Welder Qualifications	1.9															
			Silica Fume Manufacturer's	1.6.3.3															
			Representative																
			VOC Content for Form Release	1.6.3.4															
			Agents, Curing Compounds, and																
			Concrete Penetrating Sealers																
			Safety Data Sheets	1.6.3.5															
			Ready-mixed Concrete	2.5.5															
			Manufacturer (Plant) and Trucks																
			Field Testing Technician and	1.6.6.2															
			Testing Agency																
			SD-08 Manufacturer’s Instructions																
			Liquid Chemical Floor Hardeners	2.4.2.1															
			and Sealers																
			Joint Sealants	2.4.4	S														
			Curing Compounds	2.4.1															
		03 54 13	SD-03 Product Data																
			Product Data	2.1.1	G	AE													
		04 20 00	SD-03 Product Data																

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		04 20 00	Hot Weather Procedures	1.5.1	G													
			Cold Weather Procedures	1.5.2	G													
			Clay or Shale Brick	2.2.2	G													
			Cementitious Materials	2.3.1.1	G													
			SD-04 Samples															
			Mock-Up Panel	1.3.1.1	G													
			Clay or Shale Brick	2.2.2	G													
			Concrete Masonry Units (CMU)	2.2.3.2	G													
			Admixtures for Masonry Mortar	2.3.1.4	G													
			Anchors, Ties, and Bar	2.5.1	G													
			Positioners															
			SD-05 Design Data															
			Masonry Compressive Strength	2.1.2	G													
			Stone	2.2.4	G													
			SD-06 Test Reports															
			Efflorescence Test	2.2.2.1.5														
			Field Testing of Mortar	3.6.1.1														
			SD-07 Certificates															
			Special Masonry Inspector	1.3.2														
			Qualifications															
			Clay or Shale Brick	2.2.2														
			Concrete Masonry Units (CMU)	2.2.3.2														
			Cementitious Materials	2.3.1.1														
			Anchors, Ties, and Bar	2.5.1														
			Positioners															
			SD-08 Manufacturer’s Instructions															

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		04 20 00	Admixtures for Masonry Mortar	2.3.1.4															
			SD-10 Operation and Maintenance																
			Data																
			Take-Back Program	3.8															
			SD-11 Closeout Submittals																
			Clay Units	2.2.2.1.4	S														
			Recycled Content	2.2.3.2.1	S														
		05 05 20	SD-01 Preconstruction Submittals																
			Installer Qualifications	1.5.1.1	G														
			Post-Installed Anchor Special	1.5.1.2	G														
			Inspector Qualifications																
			SD-03 Product Data																
			Mechanical Anchors in Concrete	2.1.1.3	G														
			Adhesive Anchor System in	2.1.1.4	G														
			Concrete																
			Non-Shrink, Non-Metallic Grout	3.1.3	G														
			SD-06 Test Reports																
			Post-Installed Anchor Special	3.3.4	G														
			Inspections Report																
			SD-07 Certificates																
			Post-Installed Anchor	2.1.1.1	G														
			Certification																
			SD-08 Manufacturer’s Instructions																
			Manufacturer's Printed	2.1.1.2	G														
			Installation Instructions																
			Non-Shrink, Non-Metallic Grout	3.1.3	G														

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		05 05 20	Manufacturer's Material Safety	1.5															
			Data Sheets																
		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	1.3.4															
			Tacker Qualification																
			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																
			Certified Welding Procedure	1.3.1															
			Specifications (WPS)																
			Certified Procedure Qualification	1.3.1															
			Records (PQR)																
			Certified Welder Performance	1.3.1															
			Qualifications (WPQ)																
			Certified Welding Inspector	1.3.5															
			Nondestructive Testing Personnel	1.3.5															
		05 30 00	SD-02 Shop Drawings																
			Fabrication Drawings	1.3.5	G														
			SD-03 Product Data																

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		05 30 00	Accessories	2.2															
			Deck Units	2.1															
			Galvanizing Repair Paint	2.1.3															
			Galvanizing Repair Paint	3.2.4.1															
			Mechanical Fasteners	2.2.11															
			Touch-Up Paint	2.1.3															
			Welding Equipment	1.3.3															
			Welding Rods and Accessories	1.3.3															
			Recycled Content of Steel	2.1	S														
			Products																
			SD-04 Samples																
			Metal Roof Deck Units	2.1.1															
			Flexible Closure Strips	2.2.3															
			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															
		05 40 00	SD-02 Shop Drawings																
			Framing Components	1.5.1	G														
			SD-03 Product Data																
			Studs, Joists	2.1															

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		05 40 00	Recycled Content of Steel	2.1	S														
			Products																
			SD-07 Certificates																
			Load-Bearing Cold-Formed Metal	1.4															
			Framing																
			Welds	3.2.1															
		05 44 00	SD-02 Shop Drawings																
			Truss Design Drawings	1.8	G														
			Truss Design Drawings	3.2	G														
			Truss Placement Diagram	3.2	G														
			SD-03 Product Data																
			steel truss bracing, bridging,	2.2	G														
			blocking, reinforcements,																
			fasteners, and accessories																
			SD-05 Design Data																
			Truss Design Calculations	1.7	G														
			Installation Guidelines	3.2	G														
			SD-07 Certificates																
			Mill Certificates	1.8															
			Welds	2.2															
		05 50 13	SD-02 Shop Drawings																
			Structural Steel Door Frames	2.12	G														
			Cover Plates and Frames	2.5	G														
			Floor Gratings	2.6	G														
			Bollards/Pipe Guards	2.7	G														
			Angles and Plates	2.9	G														

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		05 50 13	SD-03 Product Data																
			Corner Guards	2.4															
			Cover Plates and Frames	2.5	G														
			Floor Gratings	2.6	G														
			Structural Steel Door Frames	2.12	G														
			Downspout Terminations	2.8	G														
			Recycled Content	2.1	S														
			SD-07 Certificates																
			Certificates of Compliance	2.1	G														
			Certified Mill	2.2	G														
		06 10 00	SD-03 Product Data																
			Underlayment	2.4															
			Fire-retardant Treatment	1.8															
			Structural-use and OSB Panels	1.4.3															
			Oriented Strand Board	2.3															
			Adhesives	2.5.2															
			SD-07 Certificates																
			Certificates of Grade	1.11.1															
			Certified Sustainably Harvested	2.3.1.1	S														
			Plywood for Other Uses																
			Preservative Treatment	1.7															
			Indoor Air Quality for Aerosol	2.5.2	S														
			Adhesives																
			Indoor Air Quality for Non-aerosol	2.5.2	S														
			Adhesives																
		06 12 13	SD-03 Product Data																

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		06 12 13	Product Data	2.2.1	G	AE													
			SD-08 Manufacturer's Instructions																
			Material Safety Data	2.2.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Maintenance Manuals	2.2.1	G														
		06 41 16.00 10	SD-02 Shop Drawings																
			Shop Drawings	2.10	G	AE													
			Installation	3.1	G														
			SD-03 Product Data																
			Wood Materials	2.1	G														
			Wood Finishes	2.9	G														
			Finish Schedule	2.10.7.3	G														
			Certification	1.5.2															
			SD-04 Samples																
			Plastic Laminates	2.3	G	AE													
			Cabinet Hardware	2.6	G	AE													
			SD-07 Certificates																
			Quality Assurance	1.5	G														
			Laminate Clad Casework	2.9	G														
			Laminate Clad Casework	3.1	G														
			SD-11 Closeout Submittals																
			LEED Documentation	1.3	S														
		06 61 16	SD-02 Shop Drawings																
			Installation	3.1	G														
			SD-03 Product Data																

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		06 61 16	Solid Polymer	2.1.1	G													
			Indoor air quality for solid surface	2.2.2	S													
			seam and sealant products															
			SD-04 Samples															
			Material	2.1	G													
			Counter Tops	2.3.4	G													
			SD-06 Test Reports															
			Test Report Results	2.1.1														
			SD-07 Certificates															
			Qualifications	1.5.1														
			Indoor Air Quality for solid	2.1.1	S													
			surface fabrication products															
			SD-10 Operation and Maintenance															
			Data															
			Solid Polymer	2.1.1	G													
		07 14 00	SD-03 Product Data															
			Fluid-Applied Membrane	2.1														
			Membrane Primer	2.2														
			Elastomeric Sheet	2.6														
			Flexible Foam-Backed	2.8														
			Elastomeric Sheet															
			Solvent	3.3														
			Moisture Meter	3.4.1														
			Bond Breaker	2.5														
			SD-11 Closeout Submittals															
			Warranty	1.6														

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		07 14 00	Information Card	3.5														
		07 21 16	SD-03 Product Data															
			Blanket Insulation	2.1	G													
			Recycled Content for Insulation Materials	2.1.1	S													
			Energy Star Label for Insulation Materials	2.1.2	S													
			Pressure Sensitive Tape	2.3														
			Accessories	2.4														
			SD-07 Certificates															
			Indoor Air Quality for Adhesives	2.4.1	S													
			SD-08 Manufacturer’s Instructions															
			Insulation	3.3.1														
		07 22 00	SD-02 Shop Drawings															
			Insulation Board Layout	1.3	G													
			SD-03 Product Data															
			Insulation	2.1	G													
			Cover Board	1.4	G													
			Fasteners	2.3	G													
			Moisture Control	2.2	G													
			SD-06 Test Reports															
			Flame Spread Rating	1.7.1	G													
			SD-07 Certificates															
			Installer Qualifications	1.6	G													
			Acceptable Foam Blowing Agents	2.1.2	S													
			SD-08 Manufacturer’s Instructions															

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		07 22 00	Fasteners	2.3	G													
			Insulation	2.1	G													
		07 27 10	SD-02 Shop Drawings															
			Air Barrier System Shop	2.1	G													
			Drawings															
			SD-03 Product Data															
			Air Barrier System Product Data	2.1	G													
			Material Samples For Air Barrier	2.1	G													
			System															
			Manufacturer Data Sheet	2.2	G													
			SD-05 Design Data															
			Design Data And Calculations	1.8	G													
			For The Air Barrier System															
			SD-06 Test Reports															
			Design Review Report	1.8	G													
			Testing and Inspection	3.1.2	G													
			SD-07 Certificates															
			Air Barrier Inspector	1.7	G	RO												
		07 42 13	SD-01 Preconstruction Submittals															
			Qualification of Installation	1.5.1	G													
			Contractor															
			Warranty	1.8	G													
			SD-03 Product Data															
			Factory Color Finish	2.3.1														
			Closure Materials	1.5.2														
			Sealants and Caulking	2.4.1.1														

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		07 42 13	Accessories	1.5.2															
			Accessories	2.4															
			Soffits	2.2	G														
			Coating	2.3.1.6	G														
			SD-04 Samples																
			Wall Panels	2.1	G														
			Fasteners	2.1.2	G														
			Fasteners	2.1.2	G														
			SD-06 Test Reports																
			Leakage Tests	3.7.2	G														
			Chalking	2.3.1.6	G														
			SD-11 Closeout Submittals																
			Warranty	1.8	G														
			Maintenance Instructions	1.5.3	G														
			20 year 'No Dollar Limit' warranty	1.8.1															
			for labor and material																
		07 60 00	SD-02 Shop Drawings																
			Exposed Sheet Metal	2.1.1	G														
			Gutters	3.1.12	G														
			Downspouts	3.1.13	G														
			Flashing at Roof Penetrations	3.1.18	G														
			and Equipment Supports																
			Open Valley Flashing	3.1.14	G														
			Eave Flashing	3.1.15	G														
			SD-04 Samples																
			Finish Samples	1.4.2	G														

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		07 61 14.00 20	SD-02 Shop Drawings																
			Roofing	1.2.3	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														
			Attachment Clips	2.3															
			Accessories	2.4															
			Fasteners	2.4.2															
			Sealants	2.4.3															
			Warranty	1.7	G														
			Downspout Terminations	2.5	G														
			SD-04 Samples																
			Panel	2.1															
			Sealants	2.4.3															
			Intermediate Support	2.2															
			SD-05 Design Data																
			Design Calculations	1.5															
			SD-06 Test Reports																
			Field Inspection	3.6															
			Structural Performance	1.3.3															
			Finish	1.6.6															
			SD-07 Certificates																

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		07 61 14.00 20	Manufacturer's Technical	1.6.3															
			Representative																
			Installer's Qualifications	1.6.4															
			SD-08 Manufacturer’s Instructions																
			Installation	3.3	G														
			SD-11 Closeout Submittals																
			Information Card	3.8															
			Warranty	1.7															
		07 84 00	SD-02 Shop Drawings																
			Firestopping System	2.1	G														
			SD-06 Test Reports																
			Inspection	3.3	G														
			SD-07 Certificates																
			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														
			Caulking	2.5	G														
			Cleaning Solvents	2.6	G														
			Field Adhesion	3.1	G														
			SD-07 Certificates																
			Indoor Air Quality For Interior	2.1.1	S														
			Sealants																

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		07 92 00	Indoor Air Quality For Interior	2.1.3	S														
			Acoustical Sealants																
			Indoor Air Quality For Interior	2.5	S														
			Caulking																
		08 11 13	SD-02 Shop Drawings																
			Doors	2.2	G	AE													
			Doors	2.2	G	AE													
			Frames	2.7	G	AE													
			Frames	2.7	G	AE													
			Accessories	2.5	G	AE													
			SD-03 Product Data																
			Doors	2.2	G	AE													
			Recycled Content for Steel Door	2.2	S														
			Product																
			Frames	2.7	G	AE													
			Recycled Content for Steel Frame	2.7	S														
			Product																
			Accessories	2.5	G	AE													
		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														

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		08 31 00	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 34 01	SD-02 Shop Drawings															
			Installation	3.5	G													
			SD-03 Product Data															
			Forced Entry Resistant	1.3	G													
			Components															
			Installation	3.5	G													
			Components	1.4	G													
			SD-07 Certificates															
			Forced Entry Resistant	1.3	G													
			Components															
		08 34 73	SD-02 Shop Drawings															
			Fabrication Drawings	2.1	G AE													
			SD-03 Product Data															
			Hollow Metal Sound Retardant	2.1	G AE													
			Doors															
			Door Frames	2.1	G AE													
			Door Hardware	2.1	G AE													
			Door Frame Sound Infill	2.3.2	G AE													
			Thresholds	2.1	G AE													
			SD-06 Test Reports															
			Wind Loading Tests	2.4.4	G AE													

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		08 34 73	Water Leakage Tests	2.4.4	G	AE												
			Acoustical Tests	2.4.4	G	AE												
			Air Infiltration Tests	2.4.4	G	AE												
			Positive Pressure Tests	2.4.4	G	AE												
			SD-07 Certificates															
			Hollow Metal Sound Retardant	2.1	G	AE												
			Doors															
			Door Frames	2.1	G	AE												
			Door Hardware	2.1	G	AE												
			Thresholds	2.1	G													
			Assembly Test Reports	3.3.1														
		08 51 23	SD-02 Shop Drawings															
			Windows	2.2														
			Accessories	2.5														
			SD-03 Product Data															
			Steel Framing Materials	2.1.1														
			Recycled Content for Steel	2.1.1	S													
			Framing Materials															
			Fasteners	2.5.2														
			SD-04 Samples															
			Color Coating	2.7.2	G													
			Windows	2.2														
			SD-10 Operation and Maintenance															
			Data															
			Windows	2.2	G													
		08 71 00	SD-02 Shop Drawings															

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		08 71 00	Manufacturer's Detail Drawings	1.3	G	AE												
			Verification of Existing Conditions	1.3	G	AE												
			Hardware Schedule	1.5	G	AE												
			Keying System	2.3.9	G	AE												
			SD-03 Product Data															
			Hardware Items	2.3	G	AE												
			Recycled Content	1.4	S													
			SD-08 Manufacturer’s Instructions															
			Installation	3.1														
			SD-10 Operation and Maintenance															
			Data															
			Hardware Schedule	1.5	G	AE												
			SD-11 Closeout Submittals															
			Key Bitting	1.6.1	G													
		08 81 00	SD-03 Product Data															
			Insulating Glass	2.3														
			Sealants	2.4.3.1														
			SD-04 Samples															
			Insulating Glass	2.3														
			Glazing Compound	2.4.2														
			Tape	2.4.5														
			Sealing Tapes	2.4.5														
			SD-07 Certificates															
			Insulating Glass	2.3														
			SD-08 Manufacturer’s Instructions															
			Setting and Sealing Materials	2.4														

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		08 81 00	Glass Setting	3.2														
			SD-11 Closeout Submittals															
			Insulated Glass Units	1.6.1														
		08 91 00	SD-02 Shop Drawings															
			Wall Louvers	1.4	G	AE												
			SD-03 Product Data															
			Metal Wall Louvers	2.2	G	AE												
			SD-04 Samples															
			Wall Louver Samples	1.5	G	AE												
		09 29 00	SD-03 Product Data															
			Cementitious Backer Units	2.1.7	G	AE												
			Glass Mat Water-Resistant	2.1.4														
			Gypsum Tile Backing Board															
			Water-Resistant Gypsum Backing	2.1.3	G	AE												
			Board															
			Glass Mat Covered or Reinforced	2.1.5	G	AE												
			Gypsum Sheathing															
			Glass Mat Covered or Reinforced	2.1.5.1	G	AE												
			Gypsum Sheathing Sealant															
			Abuse Resistant Gypsum Board	2.1.6	G	AE												
			Accessories	2.1.11	G	AE												
			Gypsum Board	2.1.1	G	AE												
			Recycled Content for Gypsum	2.1.1	S													
			Board															
			Recycled Content for Paper	2.1.1	S													
			Facing and Gypsum Cores															

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		09 29 00	VOC Content of Joint Compound	2.1.8	S													
			SD-06 Test Reports															
			Asbestos Free Materials	2.1	G													
			Indoor Air Quality for Gypsum	2.1.1	S													
			Board															
			Indoor Air Quality for Non-aerosol	2.1.10	S													
			Adhesives															
			Indoor Air Quality for Aerosol	2.1.10	S													
			Adhesives															
			SD-08 Manufacturer's Instructions															
			Safety Data Sheets	2.1														
			SD-10 Operation and Maintenance															
			Data															
			Manufacturer Maintenance	2.1														
			Instructions															
		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	2.1.1	S													
			Tile															
			Mosaic Tile	2.1.2	G													
			Recycled Content for Mosaic Tile	2.1.2	S													
			Glazed Ceramic Wall Tile	2.1.3	G													
			Recycled Content for Glazed	2.1.3	S													
			Ceramic Wall Tile															

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		09 30 10	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													
			Cementitious Backer Units	2.5.1	G													
			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													
			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															

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		09 30 10	Porcelain Tile	2.1.1	G														
			Mosaic Tile	2.1.2	G														
			Glazed Ceramic Wall Tile	2.1.3	G														
			Transition Strips	2.1	G														
			Transition Strips	2.6.1	G														
			Metal Strips	2.6.2	G														
		09 62 38	SD-03 Product Data																
			Static-Control Resilient Flooring	2.1	G AE														
			Recycled content for Conductive	2.1.1.1	S														
			Vinyl Tile																
			Accessories	2.4	G														
			Adhesives	2.2	G														
			Warranty	1.9															
			SD-04 Samples																
			Static-Control Resilient Flooring	2.1	G AE														
			Moldings	2.3	G														
			Accessories	2.4	G														
			SD-06 Test Reports																
			Fire Resistance	2.7															
			Moisture, Alkalinity and Bond	3.2															
			Testing	3.7															
			SD-07 Certificates																
			Indoor Air Quality for Conductive	2.1.1.1	S														
			Vinyl Tile																
			Indoor Air Quality for Adhesives	2.2	S														
			Qualifications of Applicator	1.6															

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		09 62 38	SD-08 Manufacturer's Instructions																
			Static-Control Resilient Flooring	2.1	G														
			Accessories	2.4	G														
			SD-10 Operation and Maintenance																
			Data																
			Static-Control Resilient Flooring	2.1	G														
			Accessories	2.4	G														
		09 65 00	SD-02 Shop Drawings																
			Resilient Flooring and	2.8	G														
			Accessories																
			SD-03 Product Data																
			Resilient Flooring and	2.8	G														
			Accessories																
			Adhesives	2.4															
			Luxury Vinyl Tile	2.1															
			Recycled content for Luxury Vinyl	2.1	S														
			Tile																
			Wall Base	2.2															
			SD-04 Samples																
			Resilient Flooring and	2.8	G														
			Accessories																
			SD-06 Test Reports																
			Moisture, Alkalinity and Bond	3.3	G														
			Tests																
			SD-07 Certificates																

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		09 65 00	Indoor Air Quality for Luxury Vinyl Tile	2.1	S													
			Indoor Air Quality for Wall Base	2.2	S													
			Indoor Air Quality for Adhesives	2.4	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	2.8	G													
		09 67 23.14	SD-02 Shop Drawings															
			Flooring Systems	2.2	G													
			SD-03 Product Data															
			Sealer and Resin	2.4	G	AE												
			Floor Surfacing	3.3.2	G	AE												
			Conductive Sparkproof Flooring	2.3	G	AE												
			Indoor Air Quality for Primer	2.1.1	S													
			Indoor Air Quality for Top Coating	2.1.5	S													
			Indoor Air Quality for Sealer And Resin	2.4	S													
			Mixing	3.2	G													
			SD-04 Samples															
			Flooring Systems	2.2	G	AE												
			SD-06 Test Reports															
			Testing	3.4	G													

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		09 67 23.14	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 68 00	SD-02 Shop Drawings																
			Installation Drawings	3.4	G														
			SD-03 Product Data																
			Carpet	2.1	G														
			Recycled Content for Carpeting	2.1.1	S														
			Moldings	2.4	G														
			Indoor Air Quality for Aerosol	2.3	S														
			Adhesives																
			Indoor Air Quality for Non-Aerosol	2.3	S														
			Adhesives																
			Indoor Air Quality for Concrete	2.3	S														
			Primer																
			SD-04 Samples																
			Carpet	2.1	G														
			Moldings	2.4	G														
			SD-06 Test Reports																
			Moisture and Alkalinity Tests	3.2	G														
			SD-07 Certificates																
			Indoor Air Quality for Carpet	2.1.2	S														

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		09 68 00	SD-08 Manufacturer's Instructions																
			Surface Preparation	3.1															
			SD-10 Operation and Maintenance																
			Data																
			Cleaning and Protection	3.6															
			SD-11 Closeout Submittals																
			Warranty	1.6															
		09 69 13	SD-02 Shop Drawings																
			Detailed Installation Drawings	2.2.2	G	AE													
			Fabrication Drawings	2.2.1	G	AE													
			SD-03 Product Data																
			Access Flooring System	2.1	G	AE													
			Recycled Content of Access	2.1.1	S														
			Flooring System																
			Indoor Air Quality For Pedestal	2.1.5	S														
			Adhesive																
			Indoor Air Quality For Adhesives	2.2.6	S														
			SD-04 Samples																
			Floor Panels	2.2															
			Floor Covering	2.2.4	G														
			Panel Support System	2.3	G	AE													
			Cut Outs	2.6	G	AE													
			SD-06 Test Reports																
			Factory Tests	2.4															
			Concentrated Load	2.1.1															
			Uniform Live Load	2.1.1															

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		09 69 13	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	2.1.5														
			Adhesive															
			Electrical Resistance	3.2.4														
			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	3.4	G													
			Manuals															
			SD-11 Closeout Submittals															
			Lifting Device	2.2.7														
			Warranty	1.6	G													
		09 90 00	SD-02 Shop Drawings															
			Piping Identification	3.10														
			SD-03 Product Data															
			Coating	2.1	G													

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		09 90 00	Product Data Sheets	2.1															
			SD-04 Samples																
			Color	2.2	G														
			SD-07 Certificates																
			Qualification Testing	1.6.5.2	G														
			Indoor Air Quality for Paints and Primers	1.6.4															
			Indoor Air Quality for Consolidated Latex Paints	1.6.4															
			SD-08 Manufacturer’s Instructions																
			Mixing	2.1															
			Manufacturer's Safety Data Sheets	1.8.1															
			SD-10 Operation and Maintenance Data																
			Coatings	2.1	G														
		10 11 00	SD-02 Shop Drawings																
			Placement Schedule	3.1	G														
			SD-03 Product Data																
			Visual Display Unit	1.2	G														
			Visual Display Unit	2.1	G														
			SD-04 Samples																
			Aluminum	2.1.1	G														
			Glass	2.1.2	G														
			SD-07 Certificates																

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		10 11 00	Indoor air quality for	2.2.1	S														
			markerboards																
			Certificate of Compliance	1.2															
			SD-08 Manufacturer's Instructions																
			Manufacturer's Cleaning	3.3															
			Instructions																
			Manufacturer's Printed	3.2	G														
			Installation Instructions																
		10 14 00.10	SD-02 Shop Drawings																
			Approved Detail Drawings	3.1	G	AE													
			SD-03 Product Data																
			Modular Exterior Signage System	2.1	G	AE													
			Installation	3.1															
			Exterior Signage	1.2	G														
			Wind Load Requirements	1.2.1															
			SD-04 Samples																
			Exterior Signage	1.2	G	AE													
			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	2.1	G														
			Directional Signage System																
			Exit Door Tactile Sign	2.2	G														

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		10 14 00.20	Door Tags	2.3	G													
			SD-04 Samples															
			Interior Signage	1.4.1	G													
			Software	1.3	G													
			Room Identification And	2.1	G													
			Directional Signage System															
			Exit Door Tactile Sign	2.2	G													
			SD-10 Operation and Maintenance															
			Data															
			Approved Manufacturer's	3.2	G													
			Instructions															
			Protection and Cleaning	3.2.2	G													
		10 21 13	SD-02 Shop Drawings															
			Fabrication Drawings	2.1														
			Installation Drawings	3.3	G													
			SD-03 Product Data															
			Cleaning and Maintenance	2.1														
			Instructions															
			Colors And Finishes	2.8														
			Anchoring Devices and Fasteners	2.2.2														
			Hardware and Fittings	2.2.4														
			Brackets	2.2.3														
			Door Hardware	2.2.5														
			Toilet Enclosures	2.3.1														
			Pilaster Shoes	2.6														
			Finishes	2.2.4.2	G													

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		10 21 13	Finishes	2.8.2	G														
			Recycled content for solid	2.3	S														
			phenolic partitions and screens																
			SD-04 Samples																
			Colors and Finishes	2.8	G														
			Hardware and Fittings	2.2.4															
			Anchoring Devices and Fasteners	2.2.2															
			SD-07 Certificates																
			Warranty	1.6															
			Indoor air quality for solid	2.3	S														
			phenolic, through-color partitions																
			and screens																
		10 26 00	SD-02 Shop Drawings																
			Corner Guards	2.2	G														
			Wall Covering and Panels	2.3	G														
			SD-03 Product Data																
			Corner Guards	2.2	G														
			Wall Covering and Panels	2.3	G														
			Recycled content for aluminum	2.2.1	S														
			component of corner guards																
			Recycled content for steel	2.2.2	S														
			component of corner guards																
			SD-04 Samples																
			Corner Guards	2.2	G														
			Wall Covering and Panels	2.3	G														
			SD-06 Test Reports																

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		10 26 00	Fire Resistance Rating	2.1.1.2															
			SD-07 Certificates																
			Indoor air quality for wall	2.3	S														
			covering/panels																
			Indoor air quality for adhesives	2.6	S														
			SD-10 Operation and Maintenance																
			Data																
			Corner Guards	2.2	G														
			Wall Covering and Panels	2.3	G														
		10 28 13	SD-02 Shop Drawings																
			Product Schedule	2.1	G														
			SD-03 Product Data																
			Recycled content for stainless	2.1	S														
			steel toilet accessories																
			Finishes	2.1.2	G	AE													
			Accessory Items	2.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Accessory Items	2.1	G														
		10 44 16	SD-02 Shop Drawings																
			Fire Extinguishers	2.1.1	G	AE													
			Accessories	Part 2	G	AE													
			Cabinets	Part 2	G	AE													
			Wall Brackets	2.2.2	G														
			Schedule	1.5	G														
			SD-03 Product Data																

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		10 44 16	Fire Extinguishers	2.1.1	G	AE													
			Accessories	Part 2	G	AE													
			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	AE													
			SD-07 Certificates																
			Fire Extinguishers Certifications	2.1.1	G														
			Manufacturer's Warranty with	1.4	G														
			Inspection Tag																
		10 51 13	SD-02 Shop Drawings																
			Types	2.1	G	AE													
			Location	1.4	G														
			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															
			Finish	2.2.2															
			components	2.3															
			Assembly	3.1															
			SD-04 Samples																
			Color chips	1.5.1	G	AE													
		11 13 19.23	SD-02 Shop Drawings																

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		11 13 19.23	Dock Equipment	2.2														
			Dock Equipment	2.2.4														
			SD-03 Product Data															
			Dock Equipment	2.2														
			Dock Equipment	2.2.4														
			Hydraulic Dock Lift	2.2														
			Remote Located Control Station	2.2.4.5.1														
			SD-05 Design Data															
			Electrical Requirements	2.2.4.5.1														
			SD-08 Manufacturer’s Instructions															
			Safety Devices	2.2.4.6														
			SD-10 Operation and Maintenance															
			Data															
			Operating Manuals	2.2.4.5.1														
			Maintenance Data	2.2.4.5.1														
		12 48 13	SD-02 Shop Drawings															
			Installation Drawings	3.2	G													
			Detail Drawings	3.2	G	AE												
			SD-03 Product Data															
			Entrance Floor Mats	2.1.1	G	AE												
			Adhesives and Concrete Primers	2.1.2	G													
			SD-04 Samples															
			Entrance Floor Mats	2.1.1	G	AE												
			SD-08 Manufacturer’s Instructions															
			Manufacturer's Instructions	3.2														

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		12 48 13	SD-10 Operation and Maintenance																
			Data																
			Protection, Maintenance, and	3.2															
			Repair Information																
		12 50 00.13 10	SD-01 Preconstruction Submittals																
			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																

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		12 50 00.13 10	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														
			Bio-Based Content of Furniture	2.1.4	S														
		12 59 00	SD-02 Shop Drawings																
			Detail Drawings	1.4.3	G														
			SD-03 Product Data																
			Warranty	1.6	G														
			Workstations	2.2.1															
			Power and Communications	2.11															
			Recycled Content for system	2.1	S														
			furniture components																
			SD-04 Samples																
			Workstations	2.2.1	G														
			Samples	2.2.2															
			SD-06 Test Reports																
			Selected Components	2.2.4.1	G														
			Panel Acoustics	2.2.4.2	G														
			Fire Safety	1.4.2	G														
			SD-07 Certificates																
			Workstations	2.2.1	S														
			SD-10 Operation and Maintenance																
			Data																
			Assembly Manuals	2.3.1	G														

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		12 59 00	Maintenance Manuals	3.2	G														
			Cleaning	3.2	G														
			Maintenance Agreements	1.7															
			Installation	3.1	G														
		13 49 20.00 10	SD-02 Shop Drawings																
			Installation	3.2	G														
			Approved Drawings	1.3.1	G														
			SD-03 Product Data																
			RF Shielding System	3.2.1	G														
			Installation	3.2	G														
			Quality Control Plan	3.6	G														
			Qualifications	1.3.6	G														
			RF Shielded Doors	1.7.2.1	G														
			Penetrations	2.4.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Operating and Maintenance	1.7.3	G														
			Manuals																
			Service Organization	2.2.1	G														
		21 13 13	SD-01 Preconstruction Submittals																
			Qualified Fire Protection Engineer	1.2.3	G														
			(QFPE)																
			Sprinkler System Designer	1.4.2.1	G														
			Sprinkler System Installer	1.4.2.2	G														
			SD-02 Shop Drawings																
			Shop Drawing	1.2.1.1	G														

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		21 13 13	SD-03 Product Data																
			Pipe	2.2.1	G														
			Fittings	2.3.1.2	G														
			Valves	2.3.3	G														
			Alarm Valves	2.3.4	G														
			Relief Valves	2.8.4	G														
			Sprinklers	2.7	G														
			Pipe Hangers and Supports	2.3.2	G														
			Sprinkler Alarm Switch	2.4.1	G														
			Valve Supervisory (Tamper)	2.4.2	G														
			Switch																
			Fire Department Connection	2.6	G														
			Backflow Prevention Assembly	2.5	G														
			Air Vent	2.8.5	G														
			Hose Valve	2.5.1	G														
			Seismic Bracing	2.3.2	G														
			Nameplates	2.1.2	G														
			Document Storage Cabinet	3.4.16	G														
			SD-05 Design Data																
			Seismic Bracing	2.3.2	G														
			Hydraulic Calculations	1.2.1.2	G														
			SD-06 Test Reports																
			Test Procedures	3.7.1	G														
			SD-07 Certificates																
			Verification of Compliant	3.7.2.1	G														
			Installation																

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		21 13 13	Request for Government Final	3.7.2.2	G													
			Test															
			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.9	G													
			(O&M) Instructions															
			Spare Parts	1.6	G													
			SD-11 Closeout Submittals															
			As-built drawings	3.9														
		21 22 00	SD-01 Preconstruction Submittals															
			Qualified Fire Protection Engineer	1.4.2	G													
			Manufacturer's Representative	1.4.4	G													
			SD-02 Shop Drawings															
			Clean Agent system piping layout	1.5.1	G													
			Field wiring diagrams	1.5.1	G													
			SD-03 Product Data															
			Storage cylinders	2.1.5	G													
			Discharge heads	3.7.2.1	G													
			Manifolds	2.1.5	G													
			Discharge nozzles	2.1.4	G													
			Pipe	2.1.1	G													
			Pipe hangers and supports	2.1.3	G													
			Control panel	2.2	G													
			Manual actuation stations	2.4	G													
			Pressure switches	2.1.5	G													
			Storage batteries	2.3.1	G													

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		21 22 00	Smoke detectors	2.5	G													
			Visual alarms	2.7.2	G													
			Battery charger	2.3.2	G													
			Fittings	2.1.2	G													
			Audible Alarm Bells	2.7.1	G													
			Warning Signs	2.8	G													
			SD-05 Design Data															
			Clean Agent discharge	1.5.2	G													
			calculations															
			Battery capacity calculations	1.5.2	G													
			SD-07 Certificates															
			Record of Prior Installations	1.4.1	G													
			Clean Agent fire extinguishing	1.4.3	G													
			system															
			SD-10 Operation and Maintenance															
			Data															
			Clean Agent fire extinguishing	1.4.3	G													
			system															
			SD-11 Closeout Submittals															
			Remote control station operating	1.6.3	G													
			instructions															
			Record drawings	1.5.5	G													
		21 30 10	SD-01 Preconstruction Submittals															
			Qualified Fire Protection Engineer	1.6.1	G													
			Enclosure Manufacturer	1.6.4	G													
			Qualifications															

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		21 30 10	SD-02 Shop Drawings															
			As-Built Drawings	3.11.3	G													
			Piping Layout	3.3.3	G													
			Pump Room	3.3.3	G													
			Enclosure Detail Drawings	3.3.1	G													
			SD-03 Product Data															
			Catalog Data	2.1	G													
			Spare Parts	1.5														
			Preliminary Tests	3.8.2														
			Field Tests	3.8	G													
			Manufacturer's Representative	1.6.7	G													
			Field Training	3.11.2	G													
			Army Final Acceptance Test	3.8.3														
			Fire Pump Enclosure - Structural	2.13.3	G													
			Requirements															
			Fire Pump Enclosure -	2.13.4	G													
			Architectural Requirements															
			Miscellaneous Building	2.13.4.3	G													
			Accessories															
			Fire Pump Enclosure -	2.13.5	G													
			Mechanical Requirements															
			Fire Pump Enclosure - Fire	2.13.6	G													
			Protection Requirements															
			Fire Pump Enclosure - Electrical	2.13.7	G													
			Requirements															
			SD-05 Design Data															

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		21 30 10	Fire Pump Installation Drawings	3.3.2	G													
			SD-06 Test Reports															
			Preliminary Tests	3.8.2														
			Army Final Acceptance Test	3.8.3														
			SD-07 Certificates															
			Qualified Fire Protection Engineer	1.6.1														
			Qualifications of Welders	1.6.2														
			Qualifications of Installer	1.6.3														
			Preliminary Test Certification	1.6.5														
			Final Test Certification	1.6.6														
			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.11.2	G													
			Instructions															
			Flow Meter	2.12														
		22 00 00	SD-02 Shop Drawings															
			Plumbing System	3.7.1	G													
			SD-03 Product Data															
			Thermostatic Mixing Valves	2.3.3	G													
			Fixtures	2.4														
			Flush Valve Urinals	2.4.1														
			WaterSense Label for Urinal	2.4.1	S													
			Flush Tank Water Closets	2.4.2														
			WaterSense Label for Flush Tank	2.4.2	S													
			Water Closet															
			Countertop Lavatories	2.4.3														

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		22 00 00	Kitchen Sinks	2.4.4															
			Drinking-Water Coolers	2.4.5	G														
			Water Heaters	2.8	G														
			Welding	1.5.1															
			Plumbing System	3.7.1															
			Electrical Heat Tracing	2.12	G														
			SD-06 Test Reports																
			Tests, Flushing and Disinfection	3.7															
			SD-10 Operation and Maintenance																
			Data																
			Plumbing System	3.7.1	G														
		23 05 93	SD-01 Preconstruction Submittals																
			TAB Firm	1.5.5.1	G														
			SD-02 Shop Drawings																
			TAB Schematic Drawings and	1.3.2	G														
			Report Forms																
			SD-03 Product Data																
			TAB Procedures	1.5.4	G														
			Systems Readiness Check	1.3.2	G														
			TAB Verification	1.5.6.3	G														
			SD-06 Test Reports																
			Completed Pre-Final DALT	3.2.5	G														
			Report																
			Certified Final DALT Report	3.2.8	G														
			TAB Report for Season 1	1.5.7.2	G														
			TAB Report for Season 2	1.5.7.2	G														

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		23 05 93	SD-07 Certificates																
			Independent TAB Agency and	1.5.1	G														
			Personnel Qualifications																
			DALT and TAB Submittal and	1.6.2	G														
			Work Schedule																
			TAB Pre-Field Engineering	1.6.2.1	G														
			Report																
			Advanced Notice for Season 1	1.6.2	G														
			TAB Field Work																
			Prerequisite HVAC Work Check	1.6.2	G														
			Out List For Season 1																
			Advanced Notice for Season 2	1.6.2	G														
			TAB Field Work																
			Prerequisite HVAC Work Check	1.6.2	G														
			Out List For Season 2																
		23 07 00	SD-02 Shop Drawings																
			MICA Plates	3.2.2.4	G														
			Pipe Insulation Systems	2.3	G														
			Pipe Insulation Systems	3.2	G														
			Duct Insulation Systems	3.3															
			SD-03 Product Data																
			Pipe Insulation Systems	2.3	G														
			Pipe Insulation Systems	3.2	G														
			Duct Insulation Systems	3.3	G														
			SD-04 Samples																
			Display Samples	3.1.1	G														

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		23 07 00	SD-07 Certificates																
			Indoor air quality for adhesives	2.2.1	S														
			SD-08 Manufacturer's Instructions																
			Pipe Insulation Systems	2.3	G														
			Pipe Insulation Systems	3.2	G														
			Duct Insulation Systems	3.3	G														
		23 09 00	SD-02 Shop Drawings																
			DDC Contractor Design Drawings	3.2	G														
			Draft As-Built Drawings	3.2	G														
			Final As-Built Drawings	3.2	G														
			SD-03 Product Data																
			Programming Software	1.8.3	G														
			Controller Application Programs	1.8.4	G														
			Configuration Software	1.8.1	G														
			Controller Configuration Settings	1.8.2	G														
			Manufacturer's Product Data	2.2	G														
			Niagara Framework Supervisory Gateway Backups	1.8.5	G														
			Niagara Framework Engineering Tool	1.8.6	G														
			Maintenance Laptop	1.8.7	G														
			SD-06 Test Reports																
			Pre-Construction Quality Control (QC) Checklist	1.9.1	G														
			Post-Construction Quality Control (QC) Checklist	1.9.2	G														

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		23 09 00	Start-Up Testing Report	3.4.2	G														
			PVT Procedures	3.5.1	G														
			PVT Report	3.5.3	G														
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.6	G														
			(O&M) Instructions																
			Training Documentation	3.8.1	G														
			SD-11 Closeout Submittals																
			Enclosure Keys	2.5	G														
			Closeout Quality Control (QC)	1.9.3	G														
			Checklist																
		23 23 00	SD-02 Shop Drawings																
			Refrigerant Piping System	2.2	G														
			SD-03 Product Data																
			Refrigerant Piping System	2.2															
			Qualifications	1.3.1															
			Refrigerant Piping Tests	3.4															
			SD-06 Test Reports																
			Refrigerant Piping Tests	3.4															
			SD-07 Certificates																
			Service Organization	2.1															
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.3	G														
			Manuals																

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		23 23 00	Demonstrations	3.3	G														
		23 30 00	SD-02 Shop Drawings																
			Detail Drawings	1.4.4	G														
			SD-03 Product Data																
			Duct Access Doors	2.9.2	G														
			Manual Balancing Dampers	2.9.3	G														
			Automatic Smoke-Fire Dampers	2.9.4	G														
			Sound Attenuation Equipment	2.9.6	G														
			Diffusers	2.9.7.1															
			Registers and Grilles	2.9.7.2															
			In-Line Centrifugal Fans	2.10.1.1	G														
			Air Handling Units	2.11	G														
			Constant Volume, Single Duct Terminal Units	2.12.1.1	G														
			Variable Volume, Single Duct Terminal Units	2.12.1.2	G														
			Reheat Units	2.12.1.3	G														
			Indoor Air Quality for Duct Sealants	2.9.1	S														
			SD-06 Test Reports																
			Performance Tests	3.12	G														
			Damper Acceptance Test	3.10	G														
			SD-07 Certificates																
			Ozone Depleting Substances Technician Certification	1.4.3															
			SD-08 Manufacturer’s Instructions																

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		23 30 00	Manufacturer's Installation	3.2															
			Instructions																
			Operation and Maintenance	3.14.2															
			Training																
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.14.1	G														
			Manuals																
			Manual Balancing Dampers	2.9.3	G														
			Automatic Smoke-Fire Dampers	2.9.4	G														
			In-Line Centrifugal Fans	2.10.1.1	G														
			Air Handling Units	2.11	G														
			Constant Volume, Single Duct	2.12.1.1	G														
			Terminal Units																
			Variable Volume, Single Duct	2.12.1.2	G														
			Terminal Units																
			Reheat Units	2.12.1.3	G														
			SD-11 Closeout Submittals																
			Indoor Air Quality During	3.13	S														
			Construction																
		23 81 00	SD-03 Product Data																
			Spare Parts	3.7.1															
			Posted Instructions	3.4															
			Coil Corrosion Protection	2.4.1															
			System Performance Tests	3.6															
			Training	3.4	G														

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		23 81 00	Inventory	1.4															
			Manufacturer's Standard Catalog	2.1															
			Data																
			SD-06 Test Reports																
			Refrigerant Tests, Charging, and	3.5	G														
			Start-Up																
			System Performance Tests	3.6	G														
			SD-07 Certificates																
			Service Organizations	3.7.2															
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.4	G														
			Manuals																
			SD-11 Closeout Submittals																
			Ozone Depleting Substances	2.1.2.3	S														
		23 81 23	SD-03 Product Data																
			Computer Room Air Conditioner	2.1	G														
			Space Temperature Control	2.5.2	G														
			System Drawings																
			Refrigerants	1.4	S														
			Leak Detection	2.2.1.3	G														
			SD-06 Test Reports																
			Manufacturer's Factory Test	2.7.1	G														
			Plans																
			Factory Test Reports	2.7.4	G														
			Field Test Schedule	3.3.2	G														

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		23 81 23	Manufacturer's Field Test Plans	3.3.1	G														
			Field Test Reports	3.3.6	G														
			SD-07 Certificates																
			Credentials of the Manufacturer's	3.3.3	G														
			Field Test Representative																
			Ozone Depleting Substances	1.5.1															
			Technician Certification																
			Certified List Of Qualified	1.6.3															
			Permanent Service Organizations																
			SD-08 Manufacturer’s Instructions																
			Installation Manual for Each Type	3.1.2															
			of CRAC																
			SD-10 Operation and Maintenance																
			Data																
			Computer Room Air Conditioner	3.1.3	G														
			Operation and Maintenance Data																
			SD-11 Closeout Submittals																
			Indoor Air Quality During	3.2	S														
			Construction																
		23 83 00.00 20	SD-02 Shop Drawings																
			Heater Installation Drawing	3.1															
			SD-03 Product Data																
			Electric Unit Heaters	2.1															
			SD-10 Operation and Maintenance																
			Data																
			Electric Unit Heaters	2.1															

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		25 05 11.21	SD-01 Preconstruction Submittals																
			Device Account Lock Exception	3.3.2	G														
			Request																
			Multiple Ethernet Connection	3.2.5.2	G														
			Device Request																
			Contractor Computer	1.10.1.6	G														
			Cybersecurity Compliance																
			Statements																
			Contractor Temporary Network	1.10.6	G														
			Cybersecurity Compliance																
			Statements																
			Protection of Information At Rest	3.7.4	G														
			Proposal																
			Proposed STIG and SRG	1.8.1	G														
			Applicability Report																
			SD-02 Shop Drawings																
			Network Communication Report	1.8.2	G														
			Cybersecurity Riser Diagram	1.8.5	G														
			SD-03 Product Data																
			Control System Cybersecurity	1.8.7	G														
			Documentation																
			SD-06 Test Reports																
			Control System Cybersecurity	3.14.1	G														
			Testing Procedures																
			Control System Cybersecurity	3.14.3	G														
			Testing Report																

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		25 05 11.21	SD-07 Certificates																
			Software Licenses	1.9	G														
			SD-11 Closeout Submittals																
			Confidential Password Report	3.4.4.4	G														
			Enclosure Keys	3.3.7	G														
			Software and Configuration	1.8.4	G														
			Backups																
			Device Audit Record Upload	3.5.3.1	G														
			Software																
			System Maintenance Tool	3.9	G														
			Software																
			Control System Scanning Tools	3.11.1	G														
			STIG, SRG and Vendor Guide	1.8.6	G														
			Compliance Result Report																
			Control System Inventory Report	1.8.3	G														
			Integrity Verification Software	3.13.1	G														
		25 05 11.25	SD-01 Preconstruction Submittals																
			Device Account Lock Exception	3.3.2	G														
			Request																
			Multiple Ethernet Connection	3.2.4.2	G														
			Device Request																
			Contractor Computer	1.10.1.6	G														
			Cybersecurity Compliance																
			Statements																

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LRSO Hardware Software Development Facility

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		25 05 11.25	Contractor Temporary Network	1.10.6	G													
			Cybersecurity Compliance															
			Statements															
			Protection of Information At Rest	3.7.4	G													
			Proposal															
			Proposed STIG and SRG	1.8.1	G													
			Applicability Report															
			SD-02 Shop Drawings															
			Network Communication Report	1.8.2	G													
			Cybersecurity Riser Diagram	1.8.5	G													
			SD-03 Product Data															
			Control System Cybersecurity	1.8.7	G													
			Documentation															
			SD-06 Test Reports															
			Control System Cybersecurity	3.13.1	G													
			Testing Procedures															
			Control System Cybersecurity	3.13.3	G													
			Testing Report															
			SD-07 Certificates															
			Software Licenses	1.9	G													
			SD-11 Closeout Submittals															
			Confidential Password Report	3.4.5.5	G													
			Enclosure Keys	3.3.7	G													
			Software and Configuration	1.8.4	G													
			Backups															
			Auditing Front End Software	3.5.3	G													

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		25 05 11.25	Device Audit Record Upload Software	3.5.4.2	G													
			System Maintenance Tool Software	3.9	G													
			Control System Scanning Tools	3.11.2	G													
			STIG, SRG and Vendor Guide Compliance Result Report	1.8.6	G													
			Control System Inventory Report	1.8.3	G													
			Integrity Verification Software	3.12.2	G													
		25 05 11.26	SD-01 Preconstruction Submittals															
			Device Account Lock Exception Request	3.3.2	G													
			Multiple Ethernet Connection Device Request	3.2.4.2	G													
			Contractor Computer Cybersecurity Compliance Statements	1.10.1.6	G													
			Contractor Temporary Network Cybersecurity Compliance Statements	1.10.6	G													
			Protection of Information At Rest Proposal	3.7.4	G													
			Proposed STIG and SRG Applicability Report	1.8.1	G													
			SD-02 Shop Drawings															
			Network Communication Report	1.8.2	G													

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		25 05 11.26	Cybersecurity Riser Diagram	1.8.5	G													
			SD-03 Product Data															
			Control System Cybersecurity	1.8.7	G													
			Documentation															
			SD-06 Test Reports															
			Control System Cybersecurity	3.14.1	G													
			Testing Procedures															
			Control System Cybersecurity	3.14.3	G													
			Testing Report															
			SD-07 Certificates															
			Software Licenses	1.9	G													
			SD-11 Closeout Submittals															
			Confidential Password Report	3.4.4.5	G													
			Enclosure Keys	3.3.7	G													
			Software and Configuration	1.8.4	G													
			Backups															
			Auditing Front End Software	3.5.3	G													
			Device Audit Record Upload	3.5.4.2	G													
			Software															
			System Maintenance Tool	3.9	G													
			Software															
			Control System Scanning Tools	3.11.2	G													
			STIG, SRG and Vendor Guide	1.8.6	G													
			Compliance Result Report															
			Control System Inventory Report	1.8.3	G													
			Integrity Verification Software	3.13.2	G													

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		25 05 11.28	SD-01 Preconstruction Submittals															
			Device Account Lock Exception	3.3.2	G													
			Request															
			Multiple Ethernet Connection	3.2.4.2	G													
			Device Request															
			Contractor Computer	1.10.1.6	G													
			Cybersecurity Compliance															
			Statements															
			Contractor Temporary Network	1.10.6	G													
			Cybersecurity Compliance															
			Statements															
			Protection of Information At Rest	3.7.4	G													
			Proposal															
			Proposed STIG and SRG	1.8.1	G													
			Applicability Report															
			SD-02 Shop Drawings															
			Network Communication Report	1.8.2	G													
			Cybersecurity Riser Diagram	1.8.5	G													
			SD-03 Product Data															
			Control System Cybersecurity	1.8.7	G													
			Documentation															
			SD-06 Test Reports															
			Control System Cybersecurity	3.14.1	G													
			Testing Procedures															
			Control System Cybersecurity	3.14.3	G													
			Testing Report															

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		25 05 11.28	SD-07 Certificates															
			Software Licenses	1.9	G													
			SD-11 Closeout Submittals															
			Confidential Password Report	3.4.4.5	G													
			Enclosure Keys	3.3.7	G													
			Software and Configuration	1.8.4	G													
			Backups															
			Auditing Front End Software	3.5.3	G													
			Device Audit Record Upload	3.5.4.2	G													
			Software															
			System Maintenance Tool	3.9	G													
			Software															
			Control System Scanning Tools	3.11.2	G													
			STIG, SRG and Vendor Guide	1.8.6	G													
			Compliance Result Report															
			Control System Inventory Report	1.8.3	G													
			Integrity Verification Software	3.13.2	G													
		25 08 10	SD-06 Test Reports															
			PVT Plan	3.1.1	G													
			PVT Phase I Report	3.1.2.1	G													
			PVT Phase II Report	3.1.2.2	G													
			SD-07 Certificates															
			Test Instrumentation Calibration	1.4	G													
			Certificates															
		25 10 10	SD-02 Shop Drawings															

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		25 10 10	UMCS Contractor Design Drawings	3.2.1	G														
			Draft As-Built Drawings	3.2.2	G														
			Final As-Built Drawings	3.2.2	G														
			SD-03 Product Data																
			Product Data Sheets	2.1.5	G														
			Computer Software	2.4	G														
			SD-06 Test Reports																
			Pre-Construction QC Checklist	1.7	G														
			Post-Construction QC Checklist	1.7	G														
			Existing Conditions Report	3.1	G														
			Start-Up and Start-Up Testing Report	3.6	G														
			PVT Phase I Procedures	3.7.1	G														
			PVT Phase I Report	3.7.2	G														
			PVT Phase II Report	3.7.3	G														
			SD-10 Operation and Maintenance Data																
			Operation and Maintenance (O&M) Instructions	1.8	G														
			Basic Training Documentation	3.9.1	G														
			SD-11 Closeout Submittals																
			Closeout QC Checklist	1.7	G														
		26 05 73	SD-01 Preconstruction Submittals																
			Field Examination Plan	3.1	G														
			Arc Flash Label Formats	3.2.8	G														

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		26 05 73	SD-06 Test Reports															
			Field Examination	3.1.1														
			SD-07 Certificates															
			System Analyzer	1.4.1	G													
			SD-11 Closeout Submittals															
			Model Files	3.3	G													
			Load Flow Study	3.2.4	G													
			Fault Current Study	3.2.5	G													
			Arc Flash Hazard Study	3.2.6	G													
		26 20 00	SD-02 Shop Drawings															
			Panelboards	2.12	G													
			Transformers	2.15	G													
			Cable Trays	2.3	G													
			Wireways	2.27	G													
			Marking Strips	3.1.10.1	G													
			SD-03 Product Data															
			Receptacles	2.11	G													
			Circuit Breakers	2.12.3	G													
			Switches	2.9	G													
			Transformers	2.15	G													
			Enclosed Circuit Breakers	2.13	G													
			Motor Controllers	2.17	G													
			Manual Motor Starters	2.18	G													
			Metering	2.28	G													
			Secondary Bonding Busbar	2.21.3	G													
			Surge Protective Devices	2.29	G													

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		26 20 00	Cable Trays	2.3	G													
			Conductors	2.6.1	G													
			Cable Tray Design	2.3	G													
			SD-06 Test Reports															
			600-volt Wiring Test	3.5.2	G													
			Grounding System Test	3.5.5	G													
			Transformer Tests	3.5.3	G													
			Ground-fault Receptacle Test	3.5.4	G													
			SD-07 Certificates															
			Fuses	2.10	G													
			SD-09 Manufacturer’s Field															
			Reports															
			Transformer Factory Tests	2.31.1														
			SD-10 Operation and Maintenance															
			Data															
			Electrical Systems	1.6.1	G													
			Metering	2.28	G													
		26 27 13.10 30	SD-03 Product Data															
			Power Meters	2.1	G													
			Current	2.1.3	G													
			Potential Transformer	2.1.2	G													
			Protocol Modules	1.6.1	G													
			Data Recorder	1.6.2	G													
			Modem	1.6.2	G													
			SD-06 Test Reports															
			Acceptance Checks and Tests	3.3.1	G													

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		26 27 13.10 30	SD-10 Operation and Maintenance															
			Data															
			Power Meters	2.1	G													
			Protocol Modules	1.6.1	G													
			Data Recorder	1.6.2	G													
			Modem	1.6.2	G													
			SD-11 Closeout Submittals															
			System Function Verification	3.3.2	G													
		26 29 23	SD-02 Shop Drawings															
			Schematic Diagrams	1.5.1	G													
			Interconnecting Diagrams	1.5.2	G													
			Installation Drawings	1.5.3	G													
			As-Built Drawings	1.5.3	G													
			SD-03 Product Data															
			Adjustable Speed Drives	2.1	G													
			Wires and Cables	2.3														
			Equipment Schedule	1.5.4														
			SD-06 Test Reports															
			ASD Test	3.3.1														
			Performance Verification Tests	3.3.2														
			Endurance Test	3.3.3														
			SD-07 Certificates															
			Testing Agency's Field	3.3.1	G													
			Supervisor															
			SD-08 Manufacturer’s Instructions															
			Installation instructions	1.5.5														

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		26 29 23	SD-09 Manufacturer's Field															
			Reports															
			ASD Test Plan	2.5.1	G													
			Standard Products	1.5.6														
			SD-10 Operation and Maintenance															
			Data															
			Adjustable Speed Drives	2.1														
		26 32 15.00	SD-02 Shop Drawings															
			Engine-Generator Set and	2.1.1	G													
			Auxiliary Equipment															
			Auxiliary Systems	1.4.9	G													
			Detailed Drawings	1.4.8	G													
			Acceptance	3.17	G													
			SD-03 Product Data															
			Harmonic Requirements	2.1.8	G													
			Engine-Generator Set	2.1.1	G													
			Efficiencies															
			Emissions	2.12	G													
			filters	2.7.2	G													
			special tools	2.14	G													
			Engine-Generator Parameter	2.1.1														
			Schedule															
			Heat Exchanger	2.8.2														
			Generator	2.15														
			Manufacturer's Catalog	2.5														
			Spare Parts	1.7.2														

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		26 32 15.00	Onsite Training	3.12															
			Vibration-Isolation	2.1.7															
			Posted Data and Instructions	3.16	G														
			Instructions	3.6.7.1	G														
			Experience	1.4.6															
			Field Engineer	1.4.7															
			General Installation	3.2															
			Exciter	2.16															
			SD-05 Design Data																
			Performance Criteria	2.15															
			Sound Limitations	2.9	G														
			Day Tank	2.6.1															
			Power Factor	3.6.1.2															
			Heat Exchanger	2.8.2															
			Time-Delay on Alarms	2.19.5															
			Cooling System	2.8															
			Vibration Isolation	2.1.7															
			Battery Charger	2.13.3.2															
			Capacity Calculations for	2.1.1	G														
			Engine-Generator Set																
			Brake Mean Effective Pressure	2.1.1	G														
			(BMEP) Calculations																
			Torsional Vibration Stress	2.1.1	G														
			Analysis Computations																
			Capacity Calculations for	2.1.1	G														
			Batteries																

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		26 32 15.00	SD-06 Test Reports																
			Performance Tests	3.6.9															
			Factory Inspection and Tests	2.27															
			Factory Tests	2.27.2															
			Onsite Inspection and Tests	3.6	G														
			Acceptance Checks and Tests	3.9.2	G														
			Functional Acceptance Tests	3.10.2	G														
			Maintenance Procedures	3.12	G														
			Operation and Maintenance	3.12	G														
			Manuals																
			Inspections	3.6.3	G														
			Functional Acceptance Test	3.9.6	G														
			Procedure																
			SD-07 Certificates																
			Cooling System	2.8															
			Vibration Isolation	2.1.7															
			Prototype Test	2.27.2															
			Reliability and Durability	2.1.5															
			Fuel System Certification	1.4.12	G														
			Start-Up Engineer	3.8	G														
			Instructor's Qualification Resume	3.11.1	G														
			Engine Emission Limits	2.1.2.1	G														
			Sound Limitations	2.9															
			Site Visit	3.1															
			Current Balance	2.15.1															
			Materials and Equipment	2.4															

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TITLE AND LOCATION
LRSO Hardware Software Development Facility

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		26 32 15.00	Factory Inspection and Tests	2.27															
			Engine Tests	3.6.4	G														
			Generator Tests	3.6.5	G														
			Assembled Engine-Generator Set Tests	3.6.6	G														
			SD-10 Operation and Maintenance Data																
			Preliminary Assembled Operation and Maintenance Manuals	3.9.5	G														
			Posted Data and Instructions	3.16	G														
			Training Plan	3.11.2	G														
		26 33 53	SD-02 Shop Drawings																
			UPS Drawings	1.5.1	G														
			UPS Installation	1.5.2	G														
			SD-03 Product Data																
			UPS Module	2.5	G														
			Technical Requirements UPS System	2.4															
			Spare Parts	1.4.2	G														
			SD-06 Test Reports																
			Work Plan	1.5.3	G														
			Factory Test Plan	1.5.4	G														
			Factory Test Report	1.5.5	G														
			SD-09 Manufacturer's Field Reports																
			Initial Inspection and Tests	3.2.2	G														

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		26 33 53	Performance Tests	3.2.3	G														
			Performance Test Plan	1.5.6	G														
			Performance Test Report	1.5.7	G														
			SD-10 Operation and Maintenance																
			Data																
			UPS Operation and Maintenance	1.4.1	G														
			SD-11 Closeout Submittals																
			Installation	3.1															
		26 36 23	SD-02 Shop Drawings																
			Automatic Transfer Switch	1.5.2	G														
			Drawings																
			SD-03 Product Data																
			Automatic Transfer Switches	2.1	G														
			By-Pass/Isolation Switch (BP/IS)	2.3	G														
			SD-06 Test Reports																
			Acceptance Checks and Tests	3.3.1	G														
			Functional Acceptance Tests	3.3.2	G														
			Factory Testing	2.5	G														
			Factory Test Reports	2.5.2	G														
			SD-07 Certificates																
			Proof of Listing	1.5.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	1.4	G														
			Manual																
		26 41 00	SD-06 Test Reports																

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		26 41 00	Lightning Protection and	1.5.2	G													
			Grounding System Test Plan															
			Grounding Systems Testing	3.5.2	G													
			SD-07 Certificates															
			Component UL Listed and	1.5.1	G													
			Labeled															
			Lightning Protection System	1.5.3	G													
			Inspection Certificate															
			Roof Manufacturer's Warranty	3.1.1.1	G													
		26 51 00	SD-02 Shop Drawings															
			Luminaire Drawings	1.5.1	G													
			Occupancy/Vacancy Sensor	1.5.9	G													
			Coverage Layout															
			Lighting Control System One-Line	1.7.2	G													
			Diagram															
			Sequence of Operation for	2.5.1	G													
			Lighting Control System															
			SD-03 Product Data															
			Luminaires	2.2	G													
			Light Sources	2.3	G													
			LED Drivers	2.4	G													
			Luminaire Warranty	1.6.1	G													
			Lighting Controls Warranty	1.6.2	G													
			Lighting Contactor	2.5.1.2	G													
			Switches	2.5.2.1	G													
			Digital Switch Timers	2.5.2.2	G													

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		26 51 00	Wall Box Dimmers	2.5.2.3	G													
			Occupancy/Vacancy Sensors	2.5.2.4	G													
			Power Packs	2.5.2.4.3	G													
			Exit Signs	2.6.1	G													
			Emergency Drivers	2.6.2	G													
			SD-05 Design Data															
			Luminaire Design Data	1.5.2	G													
			Photometric Plan	1.5.8	G													
			SD-06 Test Reports															
			ANSI/IES LM-79 Test Report	1.5.3	G													
			ANSI/IES LM-80 Test Report	1.5.4	G													
			ANSI/IES TM-21 Test Report	1.5.5	G													
			ANSI/IES TM-30 Test Report	1.5.6	G													
			Occupancy/Vacancy Sensor Verification Test	3.2.1.1	G													
			Photosensor Verification Test	3.2.1.1														
			SD-07 Certificates															
			LED Driver and Dimming Switch Compatibility Certificate	1.5.7	G													
			SD-10 Operation and Maintenance Data															
			Lighting System	1.7.1	G													
			Lighting Control System	1.7.2	G													
			Maintenance Staff Training Plan	3.3.2.1	G													
			End-User Training Plan	3.3.2.2	G													
		26 56 00	SD-02 Shop Drawings															

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		26 56 00	Luminaire Drawings	1.5.1.1	G													
			Pole Drawings	1.5.1.2	G													
			Control System One-Line	1.8.2	G													
			Diagram															
			Sequence of Operation for	2.5.1	G													
			Exterior Lighting Control System															
			SD-03 Product Data															
			Luminaires	2.2	G													
			Light Sources	2.3	G													
			LED Drivers	2.4	G													
			Luminaire Warranty	1.7.1	G													
			Lighting Controls Warranty	1.7.2	G													
			Pole Warranty	1.7.3	G													
			Photosensors	2.5.2.2	G													
			Time Clock	2.5.2.1	G													
			Lighting Contactor	2.5.2.3	G													
			Poles	2.6	G													
			Brackets	2.6.2														
			SD-05 Design Data															
			Luminaire Design Data	1.5.2	G													
			Photometric Plan	1.5.6	G													
			SD-06 Test Reports															
			ANSI/IES LM-79 Test Report	1.5.3	G													
			ANSI/IES LM-80 Test Report	1.5.4	G													
			ANSI/IES TM-21 Test Report	1.5.5	G													
			SD-08 Manufacturer’s Instructions															

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		26 56 00	Poles	2.6														
			SD-10 Operation and Maintenance															
			Data															
			Lighting System	1.8.1	G													
			Exterior Lighting Control System	1.8.2	G													
			Maintenance Staff Training Plan	3.3.1.1	G													
			End-User Training Plan	3.3.1.2	G													
		27 10 00	SD-02 Shop Drawings															
			Telecommunications Drawings	1.6.1.1	G													
			Telecommunications Space	1.6.1.2	G													
			Drawings															
			SD-03 Product Data															
			Telecommunications Cabling	2.3	G													
			Patch Panels	2.4.4	G													
			Telecommunications	2.5	G													
			Outlet/Connector Assemblies															
			Equipment Support Frame	2.4.2	G													
			SD-06 Test Reports															
			Telecommunications Cabling	3.5.1	G													
			Testing															
			SD-07 Certificates															
			Telecommunications Contractor	1.6.2.1	G													
			Key Personnel	1.6.2.2	G													
			Manufacturer Qualifications	1.6.2.3	G													
			Test Plan	1.6.3	G													

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		27 10 00	SD-09 Manufacturer's Field																
			Reports																
			Factory Reel Tests	2.10.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Telecommunications Cabling and	1.10.1	G														
			Pathway System																
			SD-11 Closeout Submittals																
			Record Documentation	1.10.2	G														
		28 31 76	SD-01 Preconstruction Submittals																
			Qualified Fire Protection Engineer	1.3.2	G														
			(QFPE)																
			Fire alarm system designer	1.8.2.1	G														
			Supervisor	1.8.2.2	G														
			Technician	1.8.2.3	G														
			Installer	1.8.2.4	G														
			Test Technician	1.8.2.5	G														
			Fire Alarm System Site-Specific	1.7	G														
			Software Acknowledgement																
			SD-02 Shop Drawings																
			Nameplates	1.8.1.3	G														
			Instructions	2.2.4	G														
			Wiring Diagrams	1.8.1.4	G														
			System Layout	1.8.1.5	G														
			Notification Appliances	1.8.1.6	G														
			Initiating devices	1.8.1.7	G														

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		28 31 76	Amplifiers	1.8.1.8	G													
			Battery Power	1.8.1.9	G													
			Voltage Drop Calculations	1.8.1.10	G													
			SD-03 Product Data															
			Fire Alarm and Mass Notification	2.3	G													
			Control Unit (FMCU)															
			Local Operating Console (LOC)	1.4.3	G													
			Amplifiers	1.8.1.8	G													
			Tone Generators	2.5	G													
			Digitalized voice generators	2.5	G													
			Manual Stations	2.6	G													
			Smoke Detectors	2.7	G													
			Duct Smoke Detectors	2.7.2	G													
			Air sampling smoke detectors	3.2.6	G													
			Addressable Interface Devices	2.9	G													
			Addressable Control Modules	2.10	G													
			Notification Appliances	1.8.1.6	G													
			Textual Display Signs	2.11.3	G													
			Batteries	2.13.1	G													
			Battery Chargers	2.13.2	G													
			Supplemental Notification	2.13.1.1	G													
			Appliance Circuit Panels															
			Auxiliary Power Supply Panels	2.13.1.1	G													
			Surge Protective Devices	2.14	G													
			Alarm Wiring	2.14	G													
			Back Boxes and Conduit	3.3.4	G													

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		28 31 76	Ceiling Bridges	3.2.8	G														
			Terminal Cabinets	3.3.2	G														
			Radio Transmitter and Interface	2.17.1	G														
			Panels																
			Mass Notification Transceiver	2.16.1	G														
			Environmental Enclosures or	2.19	G														
			Guards																
			Document Storage Cabinet	3.9.3	G														
			SD-05 Design Data																
			Air Sampling Smoke Detection	1.8.1.12	G														
			System Calculations																
			SD-06 Test Reports																
			Test Procedures	3.5.1	G														
			SD-07 Certificates																
			Verification of Compliant	3.5.2.1	G														
			Installation																
			Request for Government Final	3.5.2.2	G														
			Test																
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.7	G														
			(O&M) Instructions																
			Instruction of Government	3.8	G														
			Employees																
			SD-11 Closeout Submittals																
			As-Built Drawings	1.8.1.14															

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		28 31 76	Spare Parts	1.10.1														
		31 00 00	SD-01 Preconstruction Submittals															
			Excavation and Trenching Plan	3.1.3	G													
			Borrow Plan	3.2	G													
			Dewatering Work Plan	3.1.2.2	G													
			Disposition of Surplus Materials	3.9	G													
			Preconstruction Meeting	1.6.4	G													
			SD-03 Product Data															
			Flowable Fill Mix Design	2.2	G													
			SD-06 Test Reports															
			Material Test Report	3.10	G													
			Borrow Site Testing	3.2.2	G													
			Pipe Inspection Report	3.6.1.7	G													
			Geotechnical Evaluation Report	1.6.1	G													
		31 11 00	SD-01 Preconstruction Submittals															
			Herbicide Application Plan	3.1.1														
			SD-03 Product Data															
			Tree Wound Paint	2.1.1														
			Herbicides	1.3.2	G													
			SD-07 Certificates															
			Qualifications	1.3.2	G													
			SD-11 Closeout Submittals															
			Pest Management Report	3.5.1														
		32 01 19.61	SD-03 Product Data															
			Sealants	2.1														

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		32 01 19.61	Manufacturer's Recommendations	3.5.2															
			SD-04 Samples																
			Sealants	2.1															
			Blocking Media/Backup Materials	2.3.1															
			Backer Rod	3.3.3.1															
			Bond Breaking Tapes	2.3.2															
			SD-06 Test Reports																
			Sealants	2.1															
			SD-07 Certificates																
			Equipment List	3.1															
			SD-08 Manufacturer’s Instructions																
			Sealants	2.1															
		32 05 33	SD-01 Preconstruction Submittals																
			Integrated Pest Management Plan	2.3	G														
			SD-03 Product Data																
			Fertilizer	2.1	G														
			SD-07 Certificates																
			Maintenance Inspection Report	3.4.1															
			SD-10 Operation and Maintenance Data																
			Maintenance	1.6															
		32 11 23	SD-03 Product Data																
			Plant, Equipment, and Tools	2.4	G														
			SD-06 Test Reports																

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		32 11 23	Initial Tests	2.3.1	G														
			In-Place Tests	3.12.1	G														
		32 12 13	SD-03 Product Data																
			Local/Regional Materials	2.2.1															
			SD-06 Test Reports																
			Sampling and Testing	3.7															
		32 12 16.16	SD-02 Shop Drawings																
			Placement Plan	2.1	G														
			SD-03 Product Data																
			Diamond Grinding Plan	2.1.5	G														
			Mix Design	2.5	G														
			Contractor Quality Control	3.1	G														
			SD-04 Samples																
			Aggregates	2.2															
			Asphalt Cement Binder	2.3															
			Warm-mix Additive	2.5.1															
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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	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A792/A792M	(2022) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2023) 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	(2023) 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 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	(2022) 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 (2021) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D2247 (2015; R 2020) Standard Practice for Testing Water Resistance of Coatings in 100?Percent Relative Humidity

ASTM D4214 (2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films

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

U.S. DEPARTMENT OF ENERGY (DOE)

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

1.2 DEFINITIONS

1.2.1 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.

1.2.2 Pre-Formed

Formed to the final, less field-formed seam, profile and configuration in the factory.

1.2.3 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.

1.2.4 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. 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 154 miles per hour (mph). Roof system and attachments must resist the following wind loads, in pounds per square foot (psf):

	Negative
a. At eaves	100

b. At ridge	130
c. At building corners	130
c. At central areas	90

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 and 140 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 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

Attachment Clips

Accessories

Fasteners

Sealants

Sample Warranty Certificate; G

Submit for materials to be provided. Submit data sufficient to indicate conformance to specified requirements.

Downspout Terminations; G

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 and subsequently selected from manufacturer's standard color palette.

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.

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 work, including associated work, is preformed, the Contracting Officer will 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 installation, , 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.

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 in field as determined by ASTM D714; and an average rating of 6, 1/8 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 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 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.

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.

2.1.2 Texture

Smooth with raised intermediate ribs for added stiffness.

2.1.3 Finish

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 0.8 mil dry film thickness. Provide exterior primer standard with panel manufacturer with not less than 0.8 mil dry film thickness. Interior finish must consist of 0.5 mil dry film thickness backer coat. 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 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

Corrosion resisting steel, 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 DOWNSPOUT BOOT

Downspout terminations:Downspout Boots: contoured interior flow design with no boxed corners, weld seams or choke points; include integral lug slots and stainless steel fasteners.

a. Configuration: (select: Offset/
b. Material: Cast iron; ASTM A48/A48.
c. Finish: Manufacturer's standard powder coat matte black.
d. Accessories:
    1) Manufacturer's standard stainless steel fasteners for mounting onto building wall.
    2) Flexible rubber adapter for connection to drainage pipe

Amendment 0002
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2.6 FALL PROTECTION

Basis of Design (Or Approved Equal): ~~RoofSafe Rail System (https://www.fallprotect.com)~~ ***3M US Fall Protection: see the product at the following link: (https://www.arcat.com/product/3m-dbi-sala-roofsafe-rail-system-169013)***

1. System Description:

a. System consists of horizontal rooftop rail including attachment carriage, clamps, base plates, spreader plates and end stops. System to be designed for two simultaneous users.
b. System to allow attachment at any point along rail.
c. Prepare system layout, design analysis and calculations certified by a licensed Professional Engineer.

d. Do not use system as a tieback anchor for facade maintenance.
e. Maximum allowable force on a single anchorage point: 12 kN (2,698 lbf)
f. System to allow attachment at any point along rail

2. Components:

a. Clamps: Manufacturer's standard non-penetrative clamps attached to standing seam metal roof ribs.
b. Base Plates: One-piece base plate profile which directs water away from fixing points.
c. End Stops: Stops incorporated at each end of the system to provide a buffer for attachment carriages.
d. Attachment Carriage: 4-wheel carriage.
e. Fabricated supports: Steel plates, shapes and bars: ASTM A36/A36M. Steel Tubing: ASTM A500/A500M.

3. Materials:

a. Stainless Steel: ASTM A666.
b. Aluminum: 6000 series alloy.
c. Connectors: Comply with OSHA regulation 1926.502.

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Amendment 0002

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

3.3 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.

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. Locate panel end laps such that fasteners do not engage supports or otherwise restrain the longitudinal thermal movement of panels. 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

See 07 22 00 ROOF AND DECK INSULATION for additional information. Install between covering and supporting members to present a neat appearance. Fold and staple seams unless approved otherwise by the Contracting Officer.

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 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. 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 US Army Corps of Engineers, Mobile District Project Manager Bill Caswell via email at William.A.Caswell@usace.army.mil.

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 --

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 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 A1011/A1011M	(2023) 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

STEEL WINDOW INSTITUTE (SWI)

SWI SWS	(2017; R 2018) Steel Window Specifications

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 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

Accessories

SD-03 Product Data

Steel Framing Materials

Recycled Content for Steel Framing Materials; S

Fasteners

SD-04 Samples

Color Coating; G

Windows

SD-07 Certificates

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, 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. After approval, install each sample in the work, clearly identified, with location recorded.

1.4 WINDOW PERFORMANCE

Steel windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.5 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

1.6 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 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 at the plant and ship as a unit with hardware unattached. Provide the following construction:

a. Design glazed windows and rabbets suitable for glass thickness shown on drawings.

b. 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.

c. 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 PROVISIONS FOR GLAZING

Design sash for inside glazing and for securing glass with 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.

2.4 METAL-TO-METAL JOINTS

Set in mastic, using type recommended by window manufacturer to provide weathertight joints. Remove excess mastic before it hardens.

2.5 ACCESSORIES

2.5.1 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. 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.

2.5.2 Fasteners

Stainless steel or aluminum materials Prime exposed heads of coated or plated fasteners and finish to match adjacent material.

2.6 GLASS AND GLAZING

Provide materials in accordance with Section 08 81 00 GLAZING.

2.7 WINDOW FINISH

2.7.1 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.

2.7.2 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.

2.8 WINDOW TYPES

Conform to SWI SWS. Provide combinations, types and sizes indicated. Each window must consist of a unit including frame, sash, hardware, and anchors.

2.8.1 Fixed Windows

Heavy Custom windows.

PART 3 EXECUTION

3.1 INSTALLATION

Install in accordance with window manufacturer's printed instructions and details. 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. Bed screws or bolts in sill members.

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 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.

3.4 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 --

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.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2021) Butts and Hinges
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 A156.13	(2022) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.15	(2021) Release Devices Closer Holder, Electromagnetic and Electromechanical
ANSI/BHMA A156.16	(2023) Auxiliary Hardware
ANSI/BHMA A156.18	(2020) Materials and Finishes
ANSI/BHMA A156.21	(2019) Thresholds
ANSI/BHMA A156.22	(2021) Gasketing
ANSI/BHMA A156.25	(2013) Electrified Locking Devices
ANSI/BHMA A156.26	(2012) Continuous Hinges
ANSI/BHMA A156.29	(2012) Exit Locks, Exit Alarms, Alarms for Exit Devices
ANSI/BHMA A156.31	(2013) Electric Strikes and Frame Mounted Actuators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code
NFPA 72	(2022; ERTA 22-1) National Fire Alarm and Signaling Code
NFPA 80	(2022) Standard for Fire Doors and Other

Opening Protectives

NFPA 101 (2021; TIA 21-1) Life Safety Code

NFPA 252 (2022) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2023) Specifications for Standard Steel Doors and Frames

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 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 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, AE

Verification of Existing Conditions; G, AE

Hardware Schedule; G, AE

Keying System; G, AE

SD-03 Product Data

Hardware Items; G, AE

Recycled Content; S

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1; G, AE

SD-11 Closeout Submittals

Key Bitting; G

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. Provide recycled content.

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. RF Shielding

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, and closers of one lock, hinge, 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 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 STC DOORS AND RF SHIELDED DOORS 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 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. Hardware for STC/RF doors shall be provided to meet the specified resistance requirements. If STC/RF doors require specific hardware not included in this Section, it shall be provided to meet the STC/RF door's requirements at no additional cost to the Government.

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.

Interior hinges to be BHMA 652 finish (satin chrome plated) and must be cast or forged bronze or stainless steel. All fire rated doors must have a base metal of steel or stainless steel. Use full-mortise (butt) hinges except where special types are required. Use swing-clear hinges where necessary to keep door opening completely clear when door is opened 90 to 95 degrees. Use wide-throw hinges where necessary to keep door leaf clear of wall, casings, jambs, or reveals. All hinges to have a security stud with a minimum stud depth of 1/4" Hinges in doors that are exterior and that have exposed pins must be provided with anti-removal modifications, like welded, set screws, dog bolts, etc.

2.3.2 Continuous Hinges

Where continuous hinges are required, provide in accordance with ANSI/BHMA A156.26. Provide a heavy duty hinge that has capacity to handle the weight of the door. Provide continuous hinges if weight of the door exceeds the weight limit for regular hinges.

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2.3.3 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. ***Not Used*** ~~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.~~

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Amendment 0002

2.3.3.1 Mortise Locks and Latches

Provide in accordance with ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. 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.

2.3.4 X-10 Security Locks

X-10 Security lock shall conform to FS FF-L-2740B, Type 1

2.3.5 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 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.

2.3.6 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 door alarms integrated with the fire alarm system in accordance with NFPA 72.

2.3.7 Cylinders and Cores

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 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.

2.3.8 Electrified Hardware

Comply with the requirements of NFPA 70 for wiring of electrified hardware.

2.3.8.1 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 remain secure 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.

2.3.8.1.1 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.

2.3.8.1.2 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.

2.3.8.1.3 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.

2.3.8.1.4 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.

2.3.8.1.5 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.

2.3.8.2 Electrified Mortise Locks

Provide in accordance with ANSI/BHMA A156.25, Grade 1. Provide electrified mortise locks that remain secure during power failure. Provide facility interface devices that use dc power to energize solenoids. Provide solenoids, resisters, and signal switches in accordance with paragraph ELECTRIC STRIKES AND FRAME MOUNTED ACTUATORS.

2.3.8.2.1 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.

2.3.8.3 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.

2.3.8.4 Release Devices

In accordance with ANSI/BHMA A156.15, Grade 1.

2.3.8.4.1 Closer Holders

Provide header mounted closer holder devices connected by integral releasing to fire detecting devices.

2.3.9 Keying System

Provide a master keying system. Provide construction interchangeable cores. Provide key cabinet as specified.

2.3.10 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

2.3.10.1 Lever Handles

Provide lever handles. 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.

2.3.11 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Furnish four great grand master keys, four construction master keys, and four control keys for removable cores. Furnish 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.

2.3.12 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.

2.3.13 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, 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.

2.3.13.1 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.

2.3.14 Door Protection Plates

Provide in accordance with ANSI/BHMA A156.6.

2.3.14.1 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 inch kick plates for flush doors and 1 inch less than height of bottom rail for panel doors. Provide a minimum 36 inch armor plates for flush doors and completely cover lower panels of panel doors. Provide 4 inch mop plates.

2.3.15 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.

2.3.16 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.

2.3.17 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 the requirements of ANSI/BHMA A156.22. Provide weatherstripping with one of the following:

2.3.17.1 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) anodized aluminum.

2.3.18 Soundproofing Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide adjustable doorstops at heads,jambs and automatic door bottoms in accordance with the hardware set, of extruded aluminum, clear (natural) 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.

2.3.19 Auxiliary Hardware (Other than locks)

Provide in accordance with ANSI/BHMA A156.16, Grade 1.

2.3.20 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.

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2.5 FINISHES

Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel) ***or BHMA 628 finish (satin aluminum, clear anodized)***, unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint 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. 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.

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Amendment 0002

2.6 KEY CABINET AND CONTROL SYSTEM

Provide in accordance with ANSI/BHMA A156.5, 4 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.

3.1.2 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. .

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. 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

See drawings for hardware sets.

-- 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

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 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 C1281	(2016) Standard Specification for Preformed Tape Sealants for Glazing Applications
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 E2190	(2010) Standard Specification for Insulating Glass Unit Performance and Evaluation

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2008) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-1200	(1983; R 2016) Guidelines for Insulating Glass Dimensional Tolerances
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

1.2 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-03 Product Data

Insulating Glass

Sealants

SD-04 Samples

Insulating Glass

Glazing Compound

Glazing Tape

Sealing Tapes

SD-07 Certificates

Insulating Glass

SD-08 Manufacturer's Instructions

Setting and Sealing Materials

Glass Setting

SD-11 Closeout Submittals

Warranty for Insulated Glass Units

1.3 QUALITY CONTROL

Submit two 8 by 10 inch samples of each of the following: insulating glass units.

Submit three samples of each other material.

1.4 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.

1.5 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.

1.6 WARRANTY

1.6.1 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.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

2.2 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.2.1 Heat-Strengthened Glass

ASTM C1048, Kind HS (heat strengthened), Condition A (uncoated), Type I, Class 1 (clear), Quality q3, 6.0mm each glass lite thick.

2.3 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated airspace, filled with argon gas and hermetically sealed, conforming to ASTM E2190. Submit performance and compliance documentation for each type of insulating glass.

Dimensional tolerances must be as specified in IGMA TB-1200. Spacer must

be black, roll-formed, steel-reinforced butyl rubber, 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.

Both lights must be ASTM C 1048: Type 1, Class 1(clear), Quality Q3, 6.0mm thick.

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 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.

2.4.1 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.

2.4.2 Glazing Compound

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

2.4.3 Sealants

Provide elastomeric sealants.

2.4.3.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealants must be chemically compatible with setting blocks, edge blocks, and sealing tapes. Color of sealant must be white.

2.4.4 Glazing Tapes

2.4.4.1 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.

2.4.4.2 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.

2.4.5 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.

2.4.6 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.

2.4.7 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.

2.4.7.1 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.

2.4.8 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.

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 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.

3.3 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.

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 --

SECTION 13 49 20.00 10

RF SHIELDING
10/07

PART 1 GENERAL

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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 A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
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	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
~~ASTM B545~~	~~(2022) Standard Specification for Electrodeposited Coatings of Tin~~

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

~~NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)~~

~~NEMA ICS 6~~	~~(1993; R 2016) Industrial Control and Systems: Enclosures~~

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code
NFPA 77	(2024; ERTA 1 2023) 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 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

UNDERWRITERS LABORATORIES (UL)

UL 486A-486B	(2018; Reprint Jul 2023) UL Standard for Safety Wire Connectors
UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for information only and for use as specified in Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. 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

RF Shielding System; G

Installation; G

Quality Control Plan; G

Qualifications; G

RF Shielded Doors; G

~~Filter Assemblies; G~~

Penetrations; G

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals; G

Service Organization; G

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1.3 QUALITY ASSURANCE

Amendment 0002
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1.3.1 Shop Drawings

Provide fully coordinated installation and approved drawings including the complete integrated shielded enclosure systems. Provide the following integrated items including but not limited to: all steel shapes, steel deck, foil membrane systems, ~~filters,~~ doors, and penetrations. Detailed drawings showing location, number, and method of penetrating the shielding material shall be submitted. Drawings shall show erection details and sequence of erection.

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1.3.2 Penetration Schedule

The penetration schedule shall list each penetration of the RF Shield made through the walls, floors, roofs, and ceiling. Each listed penetration shall have a unique number. Each listed penetration shall have a brief description (e.g., conduit, pipe, ductwork, structure, etc.)

1.3.3 Product Data

Provide Shielding system product data including manufacturer's data, catalog cuts, and printed documentation regarding the work for the shielding system. Products requiring submittals include, but are not limited to doors, windows, foil membrane system, bronze wool, and conductive silicone.

1.3.4 RF Shielding Specialist (RSS) and System Coordinator

Work performed under this section shall be supervised and inspected by the RSS as generally defined in paragraph RF Shielding Specialist (RSS) and System Coordinator above.

1.3.5 RSS Report

The RSS shall submit RF installation reports that include photographs, documents indicating locations photographs occurred, and a description documenting materials and methods use to construct RF assembly. Document

all systems to be covered by concrete or other construction. All photographs shall be taken by the Government's photographer and note locations photos shall be taken for the reports. Every 2 weeks the RSS shall create a RF shielding report to be reviewed by the Government's field representative for approval and then forwarded to the CTTA.

1.3.6 RF 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 RF shielding. The RSS shall be a person familiar with construction work and the work interactions among multiple trades. The RSS shall have 2 years of "foreman" type experience.

1.3.6.1 Testing Experience

The testing specialist must have experience during the previous 5 years in shielded enclosure leak detection system (SELDS), IEEE 299, and other methods of shielded enclosure testing.

1.3.6.2 Work Experience

Provide RF shielded system by an experienced firm or individual that has been regularly and successfully engaged in the installation, supervision, and/or testing of equivalent RF shielded systems for at least the previous 5 years. The principal work of this firm or individual must be the satisfactory installation and construction of RF shielded protection systems. Include experience such as achieving specified requirements for shielded system attenuation and maintainability of attenuation levels on work performed.

1.3.6.3 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. Indicate project experience for installers such as installation responsibilities, performance, materials, and methods used. Project experience for the shielding specialist must indicate the responsibilities performed. Project experience for the testing specialist must indicate the test methods performed.

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1.3.7 ~~Filter and~~ Electrical Work Requirements

Perform ~~filter and~~ electrical work in compliance 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. State that the items have been tested and that they conform to the specified standard.

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1.3.8 Field Samples

Provide field samples for the following: RF shielding foil membrane system and tape, shielding fasteners, piping, duct, conduit penetrations, and any other element contributing to the continuation of the RF shielding system. These samples shall remain on the construction site in a readily accessible location for the duration of the construction for review and reference by contractor and Government personnel.

1.3.9 Pre-Installation Meeting

Hold a pre-installation meeting with the RSS, Contracting Office, Government CTTA, subcontractors and installers working in, on, or near the RF shield. Discuss coordination requirements and instructions to ensure the integrity of the RF shield.

Items to discuss, but are not limited to, at the RF pre-installation meeting:

a. Pre-construction meeting.

b. Mock-up inspection.

c. RF Construction inspection and approval process, including first inspection by CTTA and any reoccurring inspection required.

d. Accreditation testing as prerequisite for substantial completion.

1.4 RF MOCK-UP

RF mock-up shall include materials and systems noted on the construction documents and systems called for during the RF pre-construction meeting. Mock-up shall be constructed at designated areas and approved by the CTTA. Mock-up shall include, but is not limited to, the following systems that make up the overall assembly to be approved by the CTTA: Perimeter wall RF foil membrane system, seams between foil membrane modules, connection of wall and ceiling cap, connection of wall and roof, tape at penetrating steel beams, pope and conduit penetrations, duct work penetrations, conductive sealant and gasket locations, and any other transitions in RF shielding between elements.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and stored from excessive humidity and temperature variation, dirt, and other contaminants.

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1.6 PROJECT/SITE CONDITIONS

Perform welding of RF shielding material and sheet steel at an ambient temperature of 50 degrees F minimum to 90 degrees F. Do not install shielding until the building has been weather enclosed. ~~Do not perform sheet steel welding in direct sunlight.~~

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1.7 MAINTENANCE

1.7.1 Maintenance Supplies and Procedures

Provide maintenance supplies sufficient for a 3 year period or 50,000 open-close cycles, whichever is greater, for each RF shielded door. Prominently display maintenance instructions required to maintain the door through the cycle count nearby.

1.7.2 Extra Materials

1.7.2.1 RF Shielded Doors

Furnish one set RF gaskets (if used) for each hinged RF shielded door provided. In addition, provide one set of manufacturer recommended and Contracting Officer approved spare parts for RF shielded doors of each style installed.

1.7.2.2 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.

1.7.2.3 Special Tools

Provide one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment.

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1.7.3 Operating and Maintenance Manuals

Submit manufacturer's written instructions for operation and maintenance of RF Shielding system. Address all components and aspects of the RF shielding and 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 RF shielding.

c. Shield penetration schedule.

d. ***Not Used.*** ~~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. Extract complex preventive maintenance events from or refer to detailed vendor or manufacturer data. Derive this information 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. Include a complete list of recommended parts and supplies with current unit prices and source of supply.

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PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

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2.1.1 General

Provide shielded facility that meets or exceeds minimum attenuation decibel (dB) levels specified. The RF shielding system includes, but is not limited to, the following:

a. The RF shield foil membrane.

b. RF shielded doors for access into the facility.

c. Electrical and electronic penetrations of the shield.

d. ***Not Used.*** ~~RF filter/surge arrester assemblies, including their RF enclosures.~~

e. ***Not Used.*** ~~Special protective measures for mission-essential equipment outside the RF shield.~~

f. Structural penetrations.

g. Mechanical and utility penetrations (such as air ducts, gas, and water).

h. Instrumentation and control.

i. Equipment door/access panels.

j. Sufficient supervisory and/or quality control personnel onsite to supervise the installation crew and to conduct in-progress quality assurance tests.

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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. 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

For each major item of equipment, secure a plate with the manufacturer's name, address, type or style, model or serial number, and catalog number to the item of equipment.

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2.2.3 Testability

~~Design and b~~Build equipment and materials of the shielding to facilitate testing and maintenance.

2.3 RF SHIELDING EFFECTIVENESS

Provide RF shielded enclosure complete with all ~~filters,~~ doors, and/or waveguides with the following minimum RF shielding effectiveness attenuation. Use minimum electromagnetic field attenuation of 50 dB from 10 MHz to 18 GHz.

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Amendment 0002

2.4 RF SHIELD FOIL MEMBRANE SYSTEM

2.4.1 Shielding for Opaque Walls

RF Shielding material shall be a heavy duty radiant barrier sheet comprised of a layer of woven polyethelene or foil back gypsum board. Film to be perforated to allow for water vapor permeability.

Tape for seams shall be conductive adhesive tape as recommended by manufacture for shielding purposes. General purpose construction adhesive for foil contact to gypsum wall board, sheathing, steel plate, steel shapes, door frames, and concrete surfaces shall be as recommended by manufacturer.

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2.4.2 Penetrations

Seal penetrations of the shield, including bolts or fasteners, with ~~puddle welds or~~ full circumferential RF materials. Provide structural penetrations including beams, columns, and other metallic structural elements with ~~continuously welded or brazed seams and joints~~ ***RF materials***

between the penetrating element and the shield. Nonmetallic structural elements are not allowed to penetrate the electromagnetic barrier.

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2.4.3 Floor Finish

Cover floor with Vapor permeable RF shielding.

2.5 RF SHIELDED DOORS

Amendment 0002
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2.5.1 General

Material in shielded doors and frames must be steel conforming to ASTM A36/A36M or ASTM A568/A568M and stretcher-leveled and installed free of mill scale. Use thicker metal where indicated or required for its use and purpose. Provide metal thresholds of the type for proper shielding at the floor. Provide fire rated shielded doors and assemblies meeting NFPA 80 and NFPA 80A requirements and bearing the identifying label of a nationally recognized testing agency qualified to perform certification programs. Provide RF shielded doors by a single supplier who has been regularly engaged in the manufacture of these items for at least the previous 5 years. Supply assemblies complete with a rigid structural frame, hinges, latches, and parts necessary for operation. Duplicate assemblies that have been in satisfactory use for at least 2 years. Provide door frame consisting of steel suitable for bolting to the surrounding structure and shield. Provide ~~RF filters,~~ RF waveguide penetrations for door systems, and miscellaneous material for a complete system. Provide nonsagging and nonwarping enclosure door. The RF shielded door must provide a shielding effectiveness listed in the shielding section.The RF shielded doors must be prepared to accept the necessary door hardware without compromising the RF shielding. See Section 08 71 00 DOOR HARDWARE for more information. The RF shielded doors must also meet the STC rating as scheduled, see Section 08 34 73 SOUND CONTROL ASSEMBLIES for more information.

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2.5.1.1 Electric Connectivity

Provide conductive door gasketing from the door to the door frame. Provide tape from the door frame and the RF shielding as required and shown on the drawings.

2.5.2 RF Shielded Door Factory Test

Provide test data on at least one shielded door of each type provided for the facility to verify that the RF shielded doors of the design supplied have been factory tested for compliance with this specification. Do not furnish test doors on the project. Submit test data reports in accordance with paragraph SUBMITTALS.

2.5.2.1 Radio Frequency Shielding Test

Factory test RF shielded door in accordance with the requirements of this specification both before and after the mechanical tests described above.

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2.6 ***NOT USED*** ~~ELECTROMAGNETIC FILTERS~~

~~Provide a filter for each power line penetrating the shielded enclosure. These lines include, but are not limited to, power lines. Enclose filters in metallic cases which protect the filter elements from moisture and mechanical damage. Ensure all external bonding or grounding surfaces are free from insulating protective finishes. Protect all exposed metallic surfaces against corrosion by plating, lead-alloy coating, or other means. The finish must provide good electrical contact when used on a terminal or as a conductor, have uniform texture and appearance, be adherent, and free from blisters, pinholes and other defects. Insertion loss in the stop band between the load side of the filter and the power supply side must be no less than the RF shielding attenuation specified. Each filter unit must be capable of being mounted individually and include one filter for each phase conductor of the power line and the neutral conductor. Include one filter for each conductor.~~

~~2.6.1 Enclosure~~

~~Mount filter units in an RF modified NEMA Type 1 enclosure in accordance with NEMA ICS 6. Make enclosures of corrosion resistant steel of 14 gauge minimum thickness with welded seams and galvanized bulkhead cover plates. Finish enclosure nonconductive surfaces with a corrosion-inhibiting primer and two coats of baked or finish enamel. The input compartment must house the individual line filters and the input terminals. Space live parts in accordance with NFPA 70. Use copper filter leads. Test filter enclosures for shielding effectiveness in accordance with IEEE 299 and Table I of this specification.~~

~~2.6.1.1 Filter Unit Mounting~~

~~Mount each filter unit individually in an enclosure containing one filter for each penetrating conductor. Attach one end of the individual filter case to the RF barrier plate between the two compartments to provide an RF tight seal between the rf barrier plate and the filter case. The terminals of the filters must project through openings in the RF barrier plate into the inner terminal compartment. Attach the case of each filter 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 must be removable from the enclosure. Like filters must be interchangeable.~~

~~2.6.1.2 Conduit Connections to Enclosures~~

~~Provide load terminal and input compartments without knockouts, and provide each compartment with weldable threaded conduit hubs. RF weld hubs circumferentially in place and size and locate as required for the conduits indicated.~~

~~2.6.1.3 Access Openings and Cover Plates~~

~~Provide enclosures with separate clear front access cover plates on terminal and power input compartments. Provide access cover plates which are hinged with RF gaskets and 3 inch maximum bolt spacing. 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 must be tin-plated using the electrodeposited type I method in accordance with ASTM B545. Permanently fasten nuts and bolts to the enclosure by welding or captive attachments.~~

~~2.6.1.4 Operating Temperature~~

~~Provide filter assembly which is 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 RF filter enclosure). Use filter components that are suitable for continuous full load operation at a temperature from minus 55 to plus 85 degrees C.~~

~~2.6.1.5 Short Circuit Withstand~~

~~Label and build filters to have standard minimum short circuit withstand ratings as follows:~~

~~FILTER RATED CURRENT, RMS AMPERE~~	~~SHORT CIRCUIT FULL LOAD AMPERES SYMMETRICAL~~
~~0-100~~	~~10,000~~
~~101-400~~	~~14,000~~

~~2.6.1.6 Filter Connections~~

~~Provide individual filters with prewired standoffs and solderless lugs. Provide hexagonal head bolt or screw type lugs conforming to UL 486A-486B. Space live parts in accordance with NFPA 70.~~

~~2.6.2 Internal Encapsulated Filters (Filter Units)~~

~~2.6.2.1 Filter Construction~~

~~Individual filters must be heavy-duty type sealed in a steel case. After the filter is filled with an impregnating or encapsulating compound, weld the seams. When a solid potting compound is used to fill the filter, the filters may be mechanically secured and sealed with solder. Use hermetically sealed impregnated capacitors, or vacuum impregnate the complete filter assembly. Fabricate individual filter cases of no less than 14 gauge thick steel and finish with a corrosion-resistant plating, or one coat of corrosion-resistant primer and two coats of finish enamel. Fill the filter 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, must have no adverse effect on the performance of the filter. Use the same material for impregnating as is used for filling. Use copper filter terminals that can withstand the pull requirements specified and measured in accordance with paragraph RADIO FREQUENCY FILTERS.~~

~~2.6.2.2 Ratings~~

~~Provide filters in the current, voltage, and frequency ratings indicated on the drawings.~~

~~2.6.2.3 Voltage Drop~~

~~Voltage drop through the filter at operation frequency must not exceed 2 percent of the rated line voltage when the filter is fully loaded with a resistive load (unity power factor). Measure voltage drop in accordance with paragraph Voltage Drop Measurements.~~

~~2.6.2.4 Drainage of Stored Charge~~

~~Provide filters with bleeder resistors to drain the stored charge from the capacitors when power is shut off. Drain stored charge in accordance with NFPA 70.~~

~~2.6.2.5 Operating Temperature Range~~

~~Mount individual filters in the filter enclosure operating at full load amperage and rated voltage that do not exceed plus 185 degrees F based on an ambient temperature of 150 degrees F outside the filter enclosure.~~

~~2.6.2.6 Harmonic Distortion~~

~~Harmonics generated by the insertion of a filter must not increase line voltage distortion more than 2.5 percent when measured with a unity power factor in accordance with the paragraph RADIO FREQUENCY FILTERS.~~

~~2.6.3 Marking of Filter Units~~

~~Mark each filter case with the rated current, rated voltage, manufacturer s name, type of impregnating or potting compound, operating frequency, and model number. In addition, provide individual filter cases, the filter enclosures, and supply and load panelboards of filtered circuits marked by the manufacturer with the following: "WARNING: Before working on filters, terminals must be temporarily grounded to ensure discharge of capacitors. Attach nameplates and warning labels securely.~~

~~2.6.4 Minimum Life~~

~~Design filter assemblies for a minimum service life of 15 years. Submit filter schedule including voltage, amperage, enclosure type (low, high, band pass), location, cut-off frequency, and band pass frequencies.~~

~~2.6.5 Power and Signal Line Factory Testing~~

~~Submit factory test report data for each filter configuration, voltage, and amperage which shows the ability of filters to meet the specified requirements. Base filter test reports on prior tests of the same filter assembly design and components. Submit test data reports in accordance with paragraph SUBMITTALS. Include the following in the test data:~~

~~a. Voltage Drop Measurements.~~

~~b. Insertion Loss Measurements.~~

~~c. Terminals.~~

~~2.6.5.1 Voltage Drop Measurements~~

~~Perform voltage drop measurements on filters with the components mounted in the filter assembly enclosure or mounted on a metal plate by the same holding method that will be used for mounting in the enclosure. Make measurements by using expanded scale-type meters.~~

~~2.6.5.2 Insertion Loss Measurements~~

~~Insertion loss measurements for power filters must have the following modifications. Install filters in the filter assembly enclosure. Operate load current power supply at the rated voltage of the filters and provide any current from no-load through rated full-load current. The rf signal generator must be a swept continuous wave (cw) source. Modify buffer networks to permit valid measurements over the entire frequency band on which insertion loss requirements are specified (14 kHz-1 Ghz). Provide receiver or network analyzer capable of operating over the entire frequency band on which insertion loss requirements are specified (14 kHz-1 Ghz). Use adequate sensitivity to provide a measurement dynamic range at least 10 dB greater than the insertion loss requirement. Use resistive load impedance which is capable of dissipating the rated full-load filter current. Make insertion loss measurements at 20 percent, 50 percent, and 100 percent of the filter full-load operating current. Do not perform load insertion loss measurements over the frequencies defined in the RF shielding effectiveness attenuation requirements for power filters. Perform load to source testing for TEMPEST.~~

~~2.6.5.3 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. Perform testing with the components mounted in the filter assembly enclosure or mounted on a plate by the same holding method that will be used for mounting in the enclosure. Apply a force of 20 pounds to the terminal. The point of application of the force and the force applied must be in the direction of the axes of the terminations. Apply force gradually to the terminal and maintain for a period of 5 to 10 seconds. Check the terminals 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.~~

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2.7 PENETRATION PLATES

Provide penetration plates that are minimum 1/4 inch thick and sized as shown on the drawings. The penetration plate must overlap the shield penetration cutout dimension by a minimum of 6 inch on each side. Bolt the penetration plate to the shield with bolts 3 inch on center.

2.8 GALVANIZING

Galvanizing, when practical and not otherwise indicated, must be

hot-dipped processed after fabrication. Galvanizing must be in accordance with ASTM A123/A123M, or ASTM A653/A653M, as applicable. Exposed fastenings must be galvanically compatible material. Avoid electrolytic couples and dissimilar metals that tend to seize or gall.

2.9 SECURITY BARS

Provide Security bars for all ventilation penetration exceeding 96 square inches or with any dimension 6 inches or greater. Submit detailed drawings of security bars. Security bars shall be a minimum of 1/2 inch diameter hardened steel, welded vertically and horizontally 6 inches on center; a deviation of 1/2 inch in vertical and/or horizontal spacing is permissible. An access door shall be installed inside the secure perimeter to allow visual inspection of the bars.

2.10 DUCTWORK PENETRATIONS

RF-shielded penetrations of HVAC ductwork shall be equipped with honeycomb waveguide vents that provide minimum electric field and plane wave attenuation indicated in paragraph RF SHIELDING EFFECTIVENESS. Waveguide construction shall be brass or steel core with a galvanized steel duct flange or sleeve as indicated. Waveguide connection to the duct shall be made via non-metallic flex connector so as not to defeat the grounding requirement. The ductwork to be installed inside of the enclosure shall be connected directly to the waveguide vent and as indicated. Frame the rough openings larger in both dimensions than the required sizes. Static pressure drop through waveguide assembly shall not exceed 0.1 inches w.g. at air velocity of 1,200 feet per minute.

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 RF shielding installer must instruct other trades in the presence and with the direction of the Government representative, in advance of the RF 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. Provide cleaners, solvents, coatings, finishes, physical barriers, and door threshold protectors as required to protect the shielding system from corrosion, damage, and degradation. Oblation approval of the shielding installation plan before construction begins.

3.2.2 Verification

Before, during, and after the RF shielding and penetration protection subsystem installation, the shielding specialist must verify and approve the installation for compliance with the specifications. Provide materials and methods, shop drawings, and other items for the shielding subsystem bearing an approval stamp of the shielding specialist. Provide compliance notification to the Contracting Officer before materials are

installed or methods performed.

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3.2.3 Inspection

During and after RF shielding and penetration protection subsystem installation, including ~~RF filters and~~ waveguides, a qualified shielding specialist must inspect the installation for compliance with the specifications. Complete the inspection before a finish or concrete topping coat is installed.

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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. 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. Frame condensed operating instructions, prepared in typed form, as specified above and post beside the diagrams before acceptance testing of the system.

3.3 RF SHIELD FOIL MEMBRANE SYSTEM INSTALLATION

Install the RF shielded foil membrane system in accordance with this specification, the drawings, and the recommendations of the manufacturer and EM shielding specialist. Handle and install shielding foil membrane system 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 RSS and CTTA.

3.3.1 Surface Preparation

Clean and buff contacting surfaces to ensure firm contact with shielding foil membrane system. Remove all sharp edges on corners, edges, and transition points where the membrane is applied to ensure the membrane is not punctured during or after the installation.

3.3.2 Installation on Opaque Surfaces

Unroll RF shielding and cut to appropriate length. Cut 12 inches longer than surface to be covered. Apply to gypsum wall board, sheathing, steel plate, steel shapes, and door frame assemblies with approved adhesive or manufacturer conductive adhesive tape. Overlap joints by a minimum of 6 inches. Seal all seams and edges with manufacturer conductive adhesive tape. Extend RF shielding to top of wall and at least 6 inches on to underside of ceiling cap. Extent RF shielding to bottom of wall and at least 6 inches on to floor RF shielding. Provide penetrations as detailed on drawings with a minimum of 6 inches overlap.

3.4 SHIELDING PENETRATION INSTALLATION

Install penetrations in accordance with requirements of the penetration schedule and coordinate with system installation.

a. Where penetrations are encountered (i.e., conduits, pipes, structural steel members, HVAC, etc.) conductive tape shall be installed from the duct/pipe surface onto the foil shielding for 6 inches onto both surfaces. Provide grounding wires on the secure side of the duct/pipe to ground bar within room.

b. A distance of 8 inches minimum shall be maintained between each penetration and adjoining penetrations, walls, floor, ceiling or structural elements. This distance is required for shielding to penetration decoupage sealing.

c. Non-metallic piping (i.e., plastic drain lines, chemical piping, etc.) shall be covered with conductive foil tape for a distance of 6 inches from the pipe surface onto the foil shielding. No grounding wires are required.

d. All conduits and pipes shall be rigidly fastened at the point of shielding penetration, mounting hardware to be placed on unshielded side (use conduit strap, channel, studs, blocking, etc., as required).

3.5 PENETRATION INSPECTION

Request and receive the Construction Engineer's approval of all penetrations. Failure to receive this approval may be cause for rejection and subsequent replacement at the Contractor's expense.

3.6 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. Perform in-progress and final acceptance testing of RF shielding and penetration protection system work as specified. Correct deficiencies at no additional cost to the Government. Maintain legible copies of the daily inspection reports by the shielding specialist at the project site, and deliver copies of the Construction Quality Control Report to the Contracting Officer on the third workday following the date of the report. 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 in the daily inspections. Attach results of inspections and tests performed in accordance with this specification to the daily Construction Quality Control Report.

3.7 FIELD TRAINING

Provide a field training course for designated operating and maintenance staff members. Provide training for a total period of 8 hours of normal working time and start after the system is functionally complete but prior to the final acceptance test. Cover all the items contained in the Operating and Maintenance Manuals.

3.8 SHIELDING QUALITY CONTROL

Integrate the Contractor's organizational structure for shielding quality control into the jobsite management. Perform testing by an independent testing firm.

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3.8.1 Hardness Critical Item Schedule

Identify hardness critical items 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 RF shield, surge arresters, RF shielded doors, shield welding, ~~electrical filters,~~ honeycomb waveguides, and waveguides-below-cutoff.

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3.8.1.1 Performance Test Plan by Independent Testing Firm

Independent testing firm to submit a performance test plan for Contracting Officer approval. Accomplish testing 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. 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 RF enclosure must show the points, during construction, when it begins and ends as well as a day-by-day test schedule. Indicate proposed dates and duration of lowest and highest frequency tests so that the Contracting Officer may be available for these final acceptance tests. Identify a test grid and provide plan for correlation of that grid to the structure.

3.8.1.2 Test Reports by Independent Testing Firm

Include the method of testing, equipment used, personnel, location of tests, and test results. Submit daily reports of results of each test performed on each portion of the shielding system to the Contracting Officer within 3 working days of the test. Clearly identify location of the area tested. Identify leaks detected during testing with sufficient accuracy to permit relocation for testing in accordance with test procedures. Submit reports of testing to the Contracting Officer with required certification by the testing agency representative or consultant. Submit three reports (in-progress test report, initial test report, and final acceptance test report) 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:
Include results of the tests in brief narrative form in this section.

Number of Copies of the Report:
Three copies.

3.9 GROUNDING

The contract drawings indicate the extent and general arrangement of the shielded enclosure grounding system. The grounding methods must 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.

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SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM
08/23

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 B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1	(2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2020) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2020) American National Standard for Electrical Metallic Tubing (EMT)
ANSI C80.5	(2020) American National Standard for Electrical Rigid Aluminum Conduit
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2022) 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 KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2021) Motors and Generators
NEMA MG 10	(2017) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(2014) Dry-Type Transformers for General Applications
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2021) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA VE 2	(2018; ERTA 1-2 2018) Cable Tray Installation Guidelines
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2021) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2011; R 2017) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code

NFPA 70E	(2024) Standard for Electrical Safety in the Workplace
NFPA 780	(2023) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
TIA-569	(2019e; Add 1 2022) Telecommunications Pathways and Spaces
TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

U.S. AIR FORCE (USAF)

AFI 32-1065	(2017) Grounding Systems

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

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.303	Electrical, General

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jan 2022) UL Standard for Safety Flexible Metal Conduit
UL 6	(2022) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 6A	(2008; Reprint Mar 2021) UL Standard for Safety Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 20	(2018; Reprint May 2023) UL Standard for Safety General-Use Snap Switches
UL 44	(2018; Reprint May 2021) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Aug 2023) UL Standard for Safety Panelboards
UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and

	Cables
UL 248-4	(2010; Reprint Apr 2019) Low-Voltage Fuses - Part 4: Class CC Fuses
UL 248-8	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 8: Class J Fuses
UL 248-10	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 10: Class L Fuses
UL 248-12	(2011; Reprint Aug 2020) Low Voltage Fuses - Part 12: Class R Fuses
UL 248-15	(2018) Low-Voltage Fuses - Part 15: Class T Fuses
UL 360	(2013; Reprint Apr 2023) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2018; Reprint Jul 2023) UL Standard for Safety Wire Connectors
UL 486C	(2018; Reprint May 2021) UL Standard for Safety Splicing Wire Connectors
UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint May 2023) UL Standard for Safety Attachment Plugs and Receptacles
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013; Reprint Jun 2022) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint Mar 2024) UL Standard for Safety Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Feb 2020) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(2011; Reprint May 2022) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 674	(2022) UL Standard for Safety Electric Motors and Generators for Use in Hazardous

	(Classified) Locations
UL 797	(2007; Reprint Apr 2023) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 854	(2020; Reprint Nov 2023) Standard for Service-Entrance Cables
UL 869A	(2006; Reprint Jun 2020) Reference Standard for Service Equipment
UL 870	(2016; Reprint Mar 2019) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2016; Reprint Sep 2023) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors
UL 1004-1	(2012; Reprint Nov 2020) UL Standard for Safety Rotating Electrical Machines - General Requirements
UL 1063	(2017; Reprint Jun 2022) UL Standard for Safety Machine-Tool Wires and Cables
UL 1203	(2023) UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
UL 1242	(2006; Reprint Apr 2022) UL Standard for Safety Electrical Intermediate Metal Conduit -- Steel
UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2021; Reprint Dec 2022) UL Standard for Safety Surge Protective Devices
UL 4248-1	(2022) UL Standard for Safety Fuseholders - Part 1: General Requirements
UL 4248-12	(2018; Reprint Feb 2022) UL Standard for Safety Fuseholders - Part 12: Class R

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.3 RELATED REQUIREMENTS

Section 25 05 11.25 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS applies to this section, with the additions and modifications specified

herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for information only and for use as specified in Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G

Transformers; G

Cable Trays; G

Wireways; G

Marking Strips Drawings; G

SD-03 Product Data

Receptacles; G

Circuit Breakers; G

Switches; G

Transformers; G

Enclosed Circuit Breakers; G

Motor Controllers; G

Manual Motor Starters; G

Metering; G

Secondary Bonding Busbar; G

Surge Protective Devices; G

Cable Trays; G

Conductors; G

SD-05 Design Data

Cable Tray Design; G

SD-06 Test Reports

600-volt Wiring Test; G

Grounding System Test; G

Transformer Tests; G

Ground-fault Receptacle Test; G

SD-07 Certificates

Fuses; G

SD-09 Manufacturer's Field Reports

Transformer Factory Tests

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G

Metering, Data Package 5; G

1.5 QUALITY ASSURANCE

1.5.1 Fuses

Submit coordination data as specified in paragraph FUSES of this section.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated. NECA NEIS 1 shall be considered the minimum standard for workmanship.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests,

is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.6 MAINTENANCE

1.6.1 Electrical Systems

Submit operation and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein. Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. Include the following:

a. Single line diagram of the "as-built" building electrical system.

b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).

c. Manufacturers' operating and maintenance manuals on active electrical equipment.

1.7 WARRANTY

Provide equipment items supported by service organizations that are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment, and devices.

2.2 CONDUIT AND FITTINGS

All conduits and outlet boxes shall be surface mounted on RF and STC rated walls and ceilings.

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40 and EPC-80 in accordance with NEMA TC 2, UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1, limited to 6 feet.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360, limited to 6 feet.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC and UL 514B.

Amendment 0002
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2.3 CABLE TRAYS

NEMA VE 2. Provide the following:

Submit cable tray design, including dimensional layout, load and seismic calculations, and fill calculations. Dimensional layout includes cable spacings, cable tray splices, and supports. Fill calculations include an index of cables for each section and identification of the lb/ft, cross sectional area, and insulation voltage class for each cable.

a. Cable trays: form a wireway system, with a nominal depth as indicated. Cable tray is to have a span/load class designation of 10A per NEMA VE 2.

b. Cable trays: constructed of aluminum ***or steel***.

c. Cable trays: include splice and end plates, dropouts, and miscellaneous hardware.

d. Edges, fittings, and hardware: finished free from burrs and sharp edges.

e. Fittings: ensure not less than load-carrying ability of straight tray sections and have manufacturer's minimum standard radius.

f. Radius of bends: as indicated.

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Amendment 0002

2.3.1 Basket-Type Cable Trays

Provide size as indicated with maximum wire mesh spacing of 2 inch by 4 inch with a flat solid bottom or plenum rated tray insert.

2.3.2 Trough-Type Cable Trays

Provide size as indicated. Cable tray must be suitable for use as an equipment grounding conductor.

2.3.3 Ladder-Type Cable Trays

Provide size as indicated with maximum rung spacing of 6 inches.

2.4 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.4.1 Floor Outlet Boxes

Provide the following:

a. Boxes: adjustable and concrete tight.

b. Each outlet: consisting of nonmetallic brass flange ring, and cover plate with 1 inch threaded plug.

c. Telecommunications outlets: consisting of surface-mounted, horizontal flush, aluminum or stainless steel housing with a receptacle as specified and 1 inch bushed side opening.

d. Receptacle outlets: consisting of surface-mounted, horizontal flush aluminum or stainless steel housing with duplex-type receptacle as specified herein.

e. Provide gaskets where necessary to ensure watertight installation.

2.4.2 Outlet Boxes for Telecommunications System

Provide the following:

a. Standard type 4 inches square by 2-1/8 inches deep except where fiber optic cabling is used a 4-11/16 inches square by 2-1/8 inches deep box shall be used.

b. Outlet boxes for wall-mounted telecommunications outlets: 4 inch by 2-1/8 inch by 2-1/8 inch deep.

c. Depth of boxes: large enough to allow manufacturers' recommended conductor bend radii.

d. Outlet boxes for fiber optic telecommunication outlets: include a minimum 3/8 inch deep single or two gang plaster ring as shown and installed using a minimum 1 inch conduit system.

e. Outlet boxes for handicapped telecommunications station: 4 inch by 2-1/8 inch by 2-1/8 inch.

2.5 CABINETS, JUNCTION BOXES, AND PULL BOXES

UL 50; volume greater than 100 cubic inches, NEMA Type 1 enclosure; sheet steel, hot-dip, zinc-coated. Where exposed to wet, damp, or corrosive environments, NEMA Type 3R.

2.6 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 24 months prior to date of delivery to site.

2.6.1 Conductors

Provide the following:

a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.

b. Conductors No. 8 AWG and larger diameter: stranded.

c. Conductors No. 10 AWG and smaller diameter: solid.

d. Conductors for remote control, alarm, and signal circuits, Classes 1, 2, and 3: stranded unless specifically indicated otherwise.

e. All conductors: copper. Conductors indicated to be No. 6 AWG or smaller diameter: copper. Conductors indicated to be No. 4 AWG and larger diameter: copper, unless type of conductor material is specifically indicated, or specified, or required by equipment manufacturer.

2.6.1.1 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

a. Branch circuits: No. 12 AWG.

b. Class 1 remote-control and signal circuits: No. 14 AWG.

c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.

d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22 AWG.

2.6.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.6.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

a. Grounding conductors: Green.

b. Neutral conductors: White for 208/120V circuits or Gray for 480/277V circuits.

c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

2.6.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

2.6.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type THWN/THHN conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where equipment or devices require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.6.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.6.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA-607 with No. 6 AWG minimum size, and sized at 2 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil.

2.6.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the primary bonding busbar (PBB) and the electrical service ground in accordance with TIA-607. Size the bonding conductor for telecommunications the same as the TBB.

2.6.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

2.6.6 Cable Tray Cable or Power Limited Tray Cable

UL listed; type TC or PLTC.

2.7 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires: insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.8 DEVICE PLATES

Provide the following:

a. UL listed, one-piece device plates for outlets to suit the devices installed.

b. For metal outlet boxes, plates on unfinished walls: zinc-coated sheet steel or cast metal having round or beveled edges.

c. For nonmetallic boxes and fittings, other suitable plates may be provided.

d. Plates on finished walls: nylon or lexan, minimum 0.03 inch wall thickness and same color as receptacle or toggle switch with which they are mounted.

e. Screws: machine-type with countersunk heads in color to match finish of plate.

f. Sectional type device plates are not be permitted.

g. Plates installed in wet locations: gasketed and UL listed for "wet locations."

2.9 SWITCHES

2.9.1 Toggle Switches

NEMA WD 1, UL 20, single pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Include the following:

a. Handles: white thermoplastic.

b. Wiring terminals: screw-type, side-wired.

c. Contacts: silver-cadmium and contact arm - one-piece copper alloy.

d. Switches: rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.9.2 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in NEMA 1, enclosure per NEMA ICS 6.

2.10 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices for proper operation. Submit coordination data for approval. Provide fuses with a voltage rating not less than circuit voltage.

2.10.1 Fuseholders

Provide in accordance with UL 4248-1.

2.10.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 248-12, Class RK-1. Provide only Class R associated fuseholders in accordance with UL 4248-12.

2.10.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 248-8, UL 248-10, UL 248-4, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for 0 to 30 amperes.

2.10.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 248-15, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.11 RECEPTACLES

Provide the following:

a. UL 498, general purpose specification grade, grounding-type. Residential grade receptacles are not acceptable.

b. Ratings and configurations: as indicated.

c. Bodies: white as per NEMA WD 1.

d. Face and body: thermoplastic supported on a metal mounting strap.

e. Dimensional requirements: per NEMA WD 6.

f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.

g. Grounding pole connected to mounting strap.

h. The receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

2.11.1 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations" with integral GFCI protection. Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, polycarbonate, UV resistant/stabilized extra-duty rated hood.

2.11.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak when the current to ground is 6 milliamperes or higher, and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.11.3 Special Purpose Receptacles

Receptacles serving communication racks are special purpose. Provide in ratings and NEMA configurations as indicated.

2.12 PANELBOARDS

Provide panelboards in accordance with the following:

a. UL 67 and UL 50 having a short-circuit current rating as indicated.

b. Panelboards for use as service disconnecting means: additionally conform to UL 869A.

c. Panelboards: circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. If it is not possible to match "specific breaker placement" during construction, obtain Government approval prior to device installation.

f. Use of "Subfeed Breakers" is not acceptable.

g. Main breaker: "separately" mounted "above" branch breakers.

h. Where "space" is indicated, make provisions for future installation of breakers.

i. Directories: indicate load served by each circuit in panelboard.

j. Directories: indicate source of service to panelboard (e.g., Panel PA served from Panel MDP).

k. Type directories and mount in holder behind transparent protective covering.

l. Panelboards: listed and labeled for their intended use.

m. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.12.1 Enclosure

Provide panelboard enclosure in accordance with the following:

a. UL 50.

b. Cabinets mounted outdoors or flush-mounted: hot-dipped galvanized after fabrication.

c. Cabinets: painted in accordance with paragraph FIELD APPLIED PAINTING.

d. Outdoor cabinets: NEMA 3R raintight with a removable steel plate 1/4 inch thick in the bottom for field drilling for conduit connections.

e. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.

f. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.

g. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.

h. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.

i. Each door: fitted with a combined catch and lock latch.

j. Keys: two provided with each lock, with all locks keyed alike.

k. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

2.12.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet. All panelboard buses shall be copper.

2.12.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current

rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Where indicated on the drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.12.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.12.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with auto-monitoring (self-test) and lockout features, "push-to-test" button, visible indication of tripped condition, and ability to detect and trip when current imbalance is 6 milliamperes or higher per requirements of UL 943 for Class A ground-fault circuit interrupter devices.

2.13 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated.

2.14 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs): UL 508 and UL 489, and provided as shown. Provide MSCPs that consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. Rate MSCPs in accordance with the requirements of NFPA 70.

2.15 TRANSFORMERS

Provide transformers in accordance with the following:

a. NEMA ST 20, general purpose, dry-type, self-cooled, ventilated.

b. Provide transformers in NEMA 1 enclosure.

c. Taps for transformers 15 kVA and larger: Two 2.5 percent taps Full Capacity Above Nominal (FCAN) and four 2.5 percent taps Full Capacity Below Nominal (FCBN).

d. Transformer insulation system:

(1) 220 degrees C insulation system for transformers 15 kVA and greater, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C.

(2) 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 80 degrees C under full-rated load in maximum ambient of 40 degrees C.

e. Transformer of 150 degrees C temperature rise is not acceptable.

f. Transformers: quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.15.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, energy efficient type. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in 10 CFR 431, Subpart K.

2.16 MOTORS

Provide motors in accordance with the following:

a. NEMA MG 1.

b. Hermetic-type sealed motor compressors: Also comply with UL 984.

c. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.

d. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.

e. Rate motors for operation on 208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.

f. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

g. Unless otherwise indicated, use continuous duty type motors if rated 1 HP and above.

h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

i. Use Inverter-Duty motors designed to operate with adjustable speed drive (ASD).

2.16.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: high efficiency types are not acceptable. In exception, for special purpose motors and motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.16.2 Premium Efficiency Polyphase and Single-Phase Motors

Select polyphase and continuous-duty single phase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10 and NEMA MG 11. In addition,

continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated. Electronically Commutated Motors (ECM) to have an integrated controller that senses rotor position and electronically commutates the stator windings to provide synchronous rotation. The rotor must be of a permanent magnet type supported by ball bearings to increase motor efficiency and longevity. The motor must maintain 70 percent or greater efficiency for its design application. ECM motors to comply with UL 1004-1.

2.16.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.16.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment using adjustable speed drive (ASD) manufacturer required wiring type and length as specified herein. Power wiring and conduit: conform to the requirements specified herein. Control wiring: provided under, and conform to, the requirements of the section specifying the associated equipment.

2.17 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

a. UL 508, NEMA ICS 1, and NEMA ICS 2.

b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.

c. Provide controllers for motors rated 1-hp 746 watts and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.

d. Provide protection for motors from immediate restart by a time adjustable restart relay.

e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch with the controller.

f. Connections to selector switch: wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand"

position.

g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: connected in motor control circuit in "hand" and "automatic" positions.

h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: made in accordance with indicated or manufacturer's approved wiring diagram.

i. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

j. Overload protective devices: provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.

k. Cover of combination motor controller and manual switch or circuit breaker: interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

2.17.1 Control Wiring

Provide control wiring in accordance with the following:

a. All control wire: stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and passing the VW-1 flame tests included in those standards.

b. Hinge wire: Class K stranding.

c. Current transformer secondary leads: not smaller than No. 10 AWG.

d. Control wire minimum size: No. 14 AWG.

e. Power wiring for 480-volt circuits and below: the same type as control wiring with No. 12 AWG minimum size.

f. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.17.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

a. NEMA ICS 4.

b. Control circuit terminal blocks for control wiring: molded or fabricated type with barriers, rated not less than 600 volts.

c. Provide terminals with removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts.

d. Terminals: not less than No. 10 in size with sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal.

e. Terminal arrangement: subject to the approval of the Contracting Officer with not less than four spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.

f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.

g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.17.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks: furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide each connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.17.3 Control Circuits

Control circuits: maximum voltage of 120 volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. Provide one fused secondary lead with the other lead grounded. For designated systems, as indicated, provide backup power supply, including connection to emergency power source. Provide for automatic switchover and alarm upon failure of primary control circuit.

2.17.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.17.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers: include compelling relays and multiple-button, station-type with pilot lights for each speed.

2.17.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations: heavy duty, oil-tight design.

2.17.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.18 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Three pole designed for surface mounting with overload protection and pilot lights.

2.18.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color: Red for running. Green for not running.

2.19 LOCKOUT REQUIREMENTS

Provide circuit breakers, disconnecting means, and other devices that are electrical energy-isolating capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147, NFPA 70E and 29 CFR 1910.303. Comply with requirements of Division 23, "Heating, Ventilating, and Air Conditioning (HVAC)" for mechanical isolation of machines and other equipment.

2.20 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires wireways, cable trays, and other accessories for telecommunications outlets and pathway in accordance with TIA-569 and as specified herein. Additional telecommunications requirements are specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.21 GROUNDING AND BONDING EQUIPMENT

2.21.1 Ground Rods

UL 467. Ground rods: cone pointed copper-clad steel, with minimum diameter of 3/4 inch and minimum length 20 feet. Sectional type rods may be used for rods 20 feet or longer.

2.21.2 Ground Bus

Copper ground bus: provided in the electrical equipment rooms as indicated.

2.21.3 Secondary Bonding Busbar

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with TIA-607. Busbars: plated for reduced contact resistance. If not plated, clean the busbar prior to fastening the conductors to the busbar and apply an anti-oxidant to the contact area to control corrosion and reduce contact resistance. Provide a Primary

bonding busbar (PBB) in the telecommunications entrance facility and a Secondary bonding busbar (SBB) in all other telecommunications rooms and equipment rooms. The Primary bonding busbar (PBB) and the Secondary bonding busbar (SBB): sized in accordance with the immediate application requirements and with consideration of future growth. Provide Secondary bonding busbars with the following:

a. Predrilled copper busbar provided with holes for use with standard sized lugs,

b. Minimum dimensions of 0.25 inch thick by 4 inches wide for the PBB with length as indicated;

c. Listed by a nationally recognized testing laboratory.

2.22 HAZARDOUS LOCATIONS

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by NFPA 70: specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of hazardous locations involved. Boundaries and classifications of hazardous locations: as indicated. Equipment in hazardous locations: comply with UL 1203 for electrical equipment and industrial controls and UL 674 for motors.

2.23 MANUFACTURER'S NAMEPLATE

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.24 FIELD FABRICATED NAMEPLATES

Provide field fabricated nameplates in accordance with the following:

a. ASTM D709.

b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.

c. Each nameplate inscription: identify the function and, when applicable, the position.

d. Nameplates: melamine plastic, 0.125 inch thick, white with black center core.

e. Provide red laminated plastic label with white center core where indicated.

f. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.

g. Minimum size of nameplates: 1 inch by 2.5 inches.

h. Lettering size and style: a minimum of 0.25 inch high normal block style.

i. For receptacles and light switches, provide clear label tape with typed, black lettering designating panel and circuit number.

2.25 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.26 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00 FIRESTOPPING.

2.27 WIREWAYS

UL 870. Material: steel epoxy painted 16 gauge for heights and depths up to 6 inches by 6 inches, and 14 gauge for heights and depths up to 12 inches by 12 inches. Provide in length required for the application with screw-cover NEMA 1 enclosure per NEMA ICS 6.

2.28 METERING

Provide metering in accordance with Section 26 27 13.10 30 ELECTRIC METERS.

2.29 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449, NFPA 780 and AFI 32-1065 at the service entrance ATS panelboards. Provide a minimum 15 year unlimited replacement warranty on SPD. Provide surge protectors in a NEMA 1 enclosure with UL approved fasteners per NEMA ICS 6. Do not install SPD inside a panelboard or switchboard enclosure. However, SPD may be installed in a separate compartment of a switchgear provided that it is supplied by a dedicated circuit breaker. Provide overcurrent fusing on each phase for self-protection from failed components and internal disconnect for each phase. Provide individual component level thermal fusing and bi-polar protection. Cable connections between a bus and SPD shall be minimum No. 10 AWG for installation at main distribution panelboards and sub-panelboards.SPD must have the same short-circuit current rating as the protected equipment and must not be installed at a point of system where the available fault current is in excess of that rating. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker. Submit performance and characteristic curves.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Phase to phase (L-L)
Each phase to neutral (L-N)
Neutral to ground (N-G)
Phase to ground (L-G)

FOR DELTA CONNECTIONS-
Phase to phase (L-L)
Phase to ground (L-G)

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G)and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs per NFPA 780 for the lightning protection system.

Maximum L-N, and N-G Voltage Protection Rating:

700V for 208Y/120V, three phase system
1,200V for 480Y/277V, three phase system

Maximum L-G Protection Rating:

700V for 208Y/120V, three phase system
1,200V for 480Y/277V, three phase system

Maximum L-L Voltage Protection Rating:

1,200V for 208Y/120V, three phase system
1,800V for 480Y/277V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120 percent of nominal voltage for 240 volts and below; 115 percent of nominal voltage above 240 volts to 480 volts.

Provide EMI/RFI filtering per UL 1283 for each mode with the capability to attenuate high frequency noise. Minimum attenuation: 20 db.

2.30 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

a. NEMA 250 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment located indoors: ANSI Light Gray, and equipment located outdoors: ANSI Light Gray.

g. Provide manufacturer's coatings for touch-up work and as specified in

paragraph FIELD APPLIED PAINTING.

2.31 SOURCE QUALITY CONTROL

2.31.1 Transformer Factory Tests

Submittal: include routine NEMA ST 20 transformer test results on each transformer and also provide the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

2.32 COORDINATED POWER SYSTEM PROTECTION

Prepare analyses as specified in Section 26 05 73 POWER SYSTEM STUDIES.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of NFPA 70 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

3.1.2 Hazardous Locations

Perform work in hazardous locations, as defined by NFPA 70, in strict accordance with NFPA 70 for particular "Class," "Division," and "Group" of hazardous locations involved. Provide conduit and cable seals where required by NFPA 70. Provide conduit with tapered threads.

3.1.3 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.3.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

3.1.4 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor.

Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral circuits are not permitted. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors in accordance with Section 07 84 00 FIRESTOPPING.

3.1.4.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.5 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.5.1 Restrictions Applicable to Aluminum Conduit

a. Do not install underground or encase in concrete or masonry.

b. Do not use brass or bronze fittings.

3.1.5.2 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

3.1.5.3 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40.

(1) Do not use where subject to physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, fire pump rooms, and where restrictions are applying to both PVC Schedule 40 and PVC Schedule 80.

(2) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

b. PVC Schedule 80.

(1) Do not use where subject to physical damage, including but not limited to, hospitals, power plant, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

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3.1.5.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS.

3.1.5.5 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40; or fiberglass. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before rising through floor slab. Plastic coating: extend minimum 6 inches above floor.

3.1.5.6 Conduit Interior to Buildings for 400 Hz Circuits

Aluminum or nonmetallic. Where 400-Hz circuit runs underground or through concrete, provide PVC Schedule 40 conduit.

3.1.5.7 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or IMC only.

3.1.5.8 Conduit Installed Under Floor Slabs

Conduit run under floor slab: located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier. Use NECA NEIS 1 Table 2a (Minimum Raceway Spacing) to determine under floor slab conduit spacing unless greater spacing is required elsewhere in this section.

3.1.5.9 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab. Where conduit rises through slab-on grade, seal all electrical penetrations to address radon mitigation and prevent infiltration of air, insects, and vermin.

3.1.5.10 Conduit Installed in Concrete Floor Slabs or Concrete Walls

PVC, Type EPC-40, unless indicated otherwise. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends must not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings must allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size: installed parallel with or at right angles to main reinforcement; when at

right angles to reinforcement, install conduit close to one of supports of slab. Where nonmetallic conduit is used, convert raceway to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.1.5.11 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inchesabove floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.5.12 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Plastic cable ties are not acceptable. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Identify independent conduit support in both fire and non-fire rated assemblies per NFPA 70. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 10 foot maximum intervals. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.5.13 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.5.14 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where

required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.5.15 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquid tight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections. Plastic cable ties are not acceptable as a support method.

3.1.5.16 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room: installed and cabling length requirements in accordance with TIA-568.1. Size conduits in accordance with TIA-569.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling): installed in accordance with TIA-569. Size conduits, wireways, and cable trays for telecommunications risers in accordance with TIA-569.

3.1.6 Cable Tray Installation

Install and ground telecommunications cable tray in accordance with TIA-569, and TIA-607, and 96th Communications Squadron Cyber Infrastructure Standards and Installation Specifications January 2024.. Ensure edges, fittings, and hardware are finished free from burrs and sharp edges. Use No. 1/0 aluminum wire if cable tray is aluminum.

3.1.7 Telecommunications Cable Support Installation

Install open top and closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable’s weight. Use these types of supports to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports: suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

3.1.8 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, or when installed in hazardous areas and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with

aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixtures for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.8.1 Boxes

Boxes for use with raceway systems: minimum 2-1/8 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 4 inches square.

3.1.8.1.1 Wall-Mounted Telecommunications Outlet Box

Provide double gang electrical boxes, minimum standard size 4-11/16 inches square and surface mount cover or 2-1/8 inches deep with plaster ring for connection of single gang faceplate. Design outlet box for recess mounting with the faceplate flush with the wall surface, at the same height as the electrical outlets.

3.1.8.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.9 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of center of grip of the operating handle of the switch or circuit breaker at its highest position is maximum 79 inches above floor or working platform or as allowed in Section 404.8 per NFPA 70. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Wall-mounted telecommunications outlets: mounted at height indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet. Measure mounting heights of receptacle outlet boxes in the hazardous areato the bottom of the outlet box.

3.1.10 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.10.1 Marking Strips

Provide marking strips for identification of power distribution, control, data, and communications cables in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.11 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.12 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of

sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.13 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.14 Grounding and Bonding

Provide in accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, access flooring support system, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Bond additional driven rods together with a minimum of 4 AWG soft bare copper wire buried to a depth of at least 12 inches. Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.14.1 Ground Rods

Provide ground rods and measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained with a single rod, additional rods, spaced on center. Spacing for additional rods must be a minimum of 40 feet. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.14.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, by exothermic weld or high compression connector. Refer to Special Documentation of Lightning Protection System and Grounding Systems in Section 26 41 00 LIGHTNING PROTECTION SYSTEM.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make high compression connections using a hydraulic or electric compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.14.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment. For raised floor equipment rooms in computer and data processing centers, provide a minimum of four, one at each corner, ground buses connected to the building grounding system. Use bolted connections in lieu of thermoweld, so they can be changed as required by additions and alterations.

3.1.14.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.14.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a Primary bonding busbar (PBB) in the telecommunications entrance facility. Install the PBB as close to the electrical service entrance grounding connection as practicable. Provide a Secondary bonding busbar (SBB) in all other telecommunications rooms and telecommunications equipment rooms. Install the SBB as close to the telecommunications room panelboard as practicable, when equipped. Where a panelboard for telecommunications equipment is not installed in the telecommunications room, locate the SBB near the backbone cabling and associated terminations. In addition, locate the SBB to provide for the shortest and straightest routing of the grounding conductors. Where a panelboard for telecommunications equipment is located within the same room or space as a SBB, bond that panelboard's alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure to the SBB. Install Secondary bonding busbars to maintain clearances as required by NFPA 70 and insulated from its support. A minimum of 2 inches separation from the wall is recommended to allow access to the rear of the busbar and adjust the mounting height to accommodate overhead or underfloor cable routing.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the PBB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors

in ferrous metallic conduit that exceeds 3 feet in length, bond the conductors to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum. Provide a telecommunications bonding backbone (TBB) that originates at the PBB extends throughout the building using the telecommunications backbone pathways, and connects to the SBBs in all telecommunications rooms and equipment rooms. Install the TBB conductors such that they are protected from physical and mechanical damage. The TBB conductors should be installed without splices and routed in the shortest possible straight-line path. Make the bonding conductor between a TBB and a SBB continuous. Where splices are necessary, the number of splices should be a minimum. Make the splices accessible and located in telecommunications spaces. Connect joined segments of a TBB using exothermic welding, irreversible compression-type connectors, or equivalent. Install all joints to be adequately supported and protected from damage. Whenever two or more TBBs are used within a multistory building, bond the TBBs together with a grounding equalizer (GE) at the top floor and at a minimum of every third floor in between. Do not connect the TBB and GE to the pathway ground, except at the PBB or the SBB.

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the PBB or SBB: utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. Bond all metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the PBB or SBB to the PBB or SBB respectively. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; bond each PBB and SBB to the vertical steel metal frame using a minimum No. 6 AWG conductor. Where the metal frame is external to the room and readily accessible, bond the metal frame to the SBB or PBB with a minimum No. 6 AWG conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the SBB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building must be listed for the intended purpose.

3.1.15 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

3.1.16 Government-Furnished Equipment

Contractor make connections to Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.17 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

Maximum allowed lead length is 3 feet avoiding 90 degree bends. Do not locate surge protective devices inside a panelboard or switchboard enclosure.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets. Provide nameplate on all equipment in access controlled spaces and areas.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting: as specified in Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test. Where applicable, test electrical equipment in accordance with NETA ATS.

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring per NETA ATS to provide direct reading of resistance. All existing wiring to be reused must also be tested.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 943.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

3.5.6 Phase Rotation Test

Perform phase rotation test to ensure proper rotation of service power prior to operation of new or reinstalled equipment using a phase rotation meter. Follow the meter manual directions performing the test.

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